

Radio- Electronics[®]

A LOOK AT INNOVATIVE
CONSUMER PRODUCTS
THAT YOU CAN BUY NOW!

\$1.50 NOV. 1983
U.K. 85p

DGS

COMPUTERS - VIDEO - STEREO - TECHNOLOGY - SERVICE

You can build an
add-on accessory and get
**HI-FI SOUND
FROM YOUR TV**

Unique new
TEST EQUIPMENT
you'll want to own

A look at
**AUDIO CASSETTE
TAPES**

Are they really different?
Ultra high-speed

ECL LOGIC IC'S
and how to use them

Build a hands-free
**VOICE
OPERATED
SWITCH**

for your cassette tape recorder

What to look for in
**WORD PROCESSING
SOFTWARE**
for your computer



PLUS:

- ★ Videogames ★ Hobby Corner
- ★ Computer Corner ★ Drawing Board
- ★ State-Of-Solid-State ★ Equipment Reports



Xcelite.[®]

The name to connect with.



Handtools for electronics?
Get Xcelite from Cooper.
The Xcelite range is truly phenomenal.
For example, there are 38 patterns
of pliers alone — including 13 genuine “miniatures.”
Xcelite handtools are made to exacting tolerances.

They're rugged and longlasting.
Most important of all, they're designed specifically to do the
jobs you do. Individual tools and kits are at your distributors now.
Go and see them!

The Cooper Group PO Box 728 Apex NC 27502 USA Tel (919) 362-7510 Telex 579497

BOKER[®] CRESCENT[®] LUFKIN[®] NICHOLSON[®] PLUMB[®] WELLER[®] WISS[®] XCELITE[®]

CooperTools

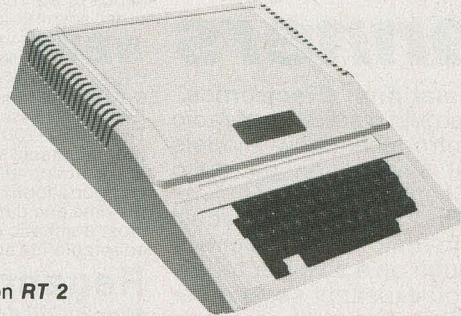
IT'S HERE AT LAST!

THE FIRST LOW COST 6502 COMPUTER WITH 48K RAM THAT'S COMPLETELY COMPATIBLE WITH APPLE II®

Introducing the RAM-TECH* RT 2 computer which offers you greater flexibility than the Apple II+® at a price that's easier on your finances. The RT 2 will run all software and use all peripheral hardware designed for the Apple II+®. It's 100% Apple® compatible yet it offers you features not available on the Apple II+®.

COMPARE THESE FEATURES:

- supports upper & lower case characters from the keyboard
- high quality ABS case will not crack and is light weight
- RF modulator included in addition to composite video output
- high quality light-touch keyboard with upper/lower case key
- 15 key numeric key pad for fast data entry (optional)
- high power switching power supply (8.5 amps total) will power two disk drives and several peripherals easily, has internal circuit breaker
- eight expansion slots to increase flexibility with peripheral cards
- 48K RAM expandable to 64K (192K RAM upgrade card available soon)
- socketed IC's for quick and easy service
- thousands of programs (business & home) available
- operates identically to the Apple II+® with exception of extra features on RT 2
- full 90 days parts and labor warranty with fast service turn-around



THE RAM-TECH* RT 2 IS EVERYTHING YOU ALWAYS WANTED FROM AN APPLE® (AND MORE), BUT THOUGHT YOU COULDN'T AFFORD. AND THAT'S GOOD NEWS!

BUT THE BEST NEWS IS THE PRICE:

\$525.00 + \$18.00 shipping & handling

WITH OPTIONAL NUMERIC KEYPAD:

\$575.00 + \$18.00 shipping & handling

COMPARED TO APPLE II® WHICH RETAILS AT MORE THAN DOUBLE THIS PRICE AND OFFERS YOU LESS, YOU CAN SEE WHY THE RAM-TECH* RT 2 SHOULD BE YOUR CHOICE. MAKE NO SYNTAX ABOUT IT, THE RT 2 IS FOR YOU!

PERSONAL I.D. OPTION — We will burn your name into ROM. When you power up your Ram-Tech your name will be displayed on the screen. **AN EXTRA MEASURE OF SECURITY AGAINST THEFT.**

Indicate on your order what name you wish to use (maximum 8 letters including spaces) — ADD: \$25.00 for I.D. option.

ALSO AVAILABLE: (sub-assemblies for do-it yourselfers) — 90 days warranty

- | | |
|--|----------|
| 1 - ABS case, high quality, Apple® look-a-like and color matched, will replace Apple® case..... | \$ 68.50 |
| 2 - same as #1 above but with numeric keypad cutout..... | \$ 84.00 |
| 3 - keyboard with upper/lower case key, direct replacement for Apple® or Ram-Tech*..... | \$110.00 |
| 4 - same as #3 above but with numeric keypad, use in combination with #2, also fits Apple®..... | \$139.50 |
| 5 - RF modulator with TV switch and cable, also fits Apple®..... | \$ 19.50 |
| 6 - switching power supply, 8.5 amps, internal circuit breaker, high power, also fits Apple®..... | \$112.00 |
| 7 - motherboard, completely assembled & tested, fully operational with burned ROMS..... | \$295.00 |
| 8 - bare motherboard w/ parts discription screened on board and instructions, highest quality G10 epoxy..... | \$ 48.00 |

SHIPPING & HANDLING FOR ABOVE: cases #1 & 2 add 10%; all others add 5%

PERIPHERALS, CARDS & ACCESSORIES FOR YOUR RAM-TECH* OR APPLE®

all items #1 to 19 guaranteed for one year (disk drives for six months)

- | | | | |
|--|----------|-------------------------------|----------|
| 1 - 16K RAM card..... | \$ 58.00 | 11 - interger card..... | \$ 97.50 |
| 2 - 80 column card..... | \$ 94.50 | 12 - PAL card..... | \$114.00 |
| 3 - clock card..... | \$135.00 | 13 - language card..... | \$ 72.50 |
| 4 - communications card..... | \$ 89.00 | 14 - RS-232 serial card..... | \$ 84.00 |
| 5 - disk controller card..... | \$ 58.00 | 15 - Z-80 CP/M card..... | \$ 92.00 |
| 6 - EPROM writer card..... | \$124.50 | 16 - VERSA card..... | \$345.00 |
| 7 - FORTH card..... | \$ 98.50 | 17 - analog/digital card..... | \$116.50 |
| 8 - IEEE-488 card w/cable..... | \$186.00 | 18 - system cooling fan..... | \$ 63.00 |
| 9 - parallel printer card w/cable..... | \$112.00 | 19 - joy stick w/button..... | \$ 24.50 |
| 10 - parallel printer buffer and grappler card with cable..... | | | \$245.00 |

DISK DRIVES: Guaranteed high quality for use with all Apple® compatible (or Ram-Tech*) controllers - DOS 3.3 & 3.2

USES SPECIAL LOW POWER CONSUMPTION CIRCUITRY

- | | | | |
|---------------|----------|-------|--------------------------|
| TEAC 55A..... | \$325.00 | | \$370.00 with controller |
| SHUGART..... | \$285.00 | | \$330.00 with controller |

SHIPPING & HANDLING: add \$3.50 per item #1 - 19 ... disk drives add \$10.00

TO ORDER

- ALL PRICES IN U.S. CURRENCY
- VISA OR MASTER CARD: SEND NUMBER, EXPIRY DATE, BANK NAME & CARD HOLDER'S NAME, INCLUDE PHONE NUMBER.
- CHECKS & MONEY ORDERS O.K. - CHECKS NEED THREE WEEKS TO CLEAR. (NO C.O.D.'S TO U.S. DUE TO POSTAL REGULATIONS)
- CANADIAN ORDERS ADD 25% FOR CDN FUNDS EXCHANGE.
- U.S. CUSTOMERS WILL HAVE TO PAY U.S. CUSTOMS 4.7% DUTY. DUTIES COLLECTED BY POST OFFICE.
- WE ASSUME NO LIABILITY FOR CUSTOMS CLEARANCE.

DEALER INQUIRIES REQUESTED

BYTE-RYTE

DEPT. RE

P.O. BOX 205, STATION CART.

MONTREAL, QUEBEC, CANADA H4K 2J5

(514) 335-1717

®Apple is a trademark of Apple Computer Inc.

*Ram-Tech is a trademark of 99506 CANADA INC.

NEW!

Regency® Scanners

Communications Electronics™, the world's largest distributor of radio scanners, introduces new models with special savings on all radio scanners. Chances are the police, fire and weather emergencies you'll read about in tomorrow's paper are coming through on a scanner today.

We give you excellent service because CE distributes more scanners worldwide than anyone else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are in stock for quick shipment, so if you're a person who prefers fact to fantasy and who needs to know what's really happening around you, order your radio today from CE.

NEW! Regency® MX3000

List price \$299.95/CE price \$199.00
6-Band, 30 Channel • No-crystal scanner
Search • Lockout • Priority • AC/DC
Bands: 30-50, 144-174, 440-512 MHz

The Regency Touch MX3000 provides the ease of computer controlled, touch-entry programming in a compact-sized scanner for use at home or on the road. Enter your favorite public service frequencies by simply touching the numbered pressure pads. You'll even hear a "beep" tone that lets you know you've made contact.

In addition to scanning the programmed channels, the MX3000 has the ability to search through as much as an entire band for an active frequency. The MX3000 includes channel 1 priority, dual scan speeds, scan or search delay and a brightness switch for day or night operation.

NEW! Regency® HX650

List price \$119.95/CE price \$84.00
5-Band, 6 Channel • Handheld crystal scanner
Bands: 30-50, 146-174, 450-512 MHz

Now you can tune in any emergency around town, from wherever you are, the second it happens. Advanced circuitry gives you the world's smallest scanner. Our low CE price includes battery charger/A.C. adapter.

NEW! Regency® MX7000

Allow 120-240 days for delivery after receipt of order due to the high demand for this product. List price \$599.95/CE price \$449.00

10-Band, 20 Channel • Crystalless • AC/DC
Frequency range: 26-27, 30-108, 108-136 AM, 144-174, 440-512, 806-881 MHz, 1.0 GHz, 1.1 GHz. In addition to normal scanner listening, the MX7000 offers CB, VHF, and UHF TV audio, FM Broadcast, all aircraft bands (civil and military), 800 MHz communications, cellular telephone, and when connected to a printer or CRT, satellite weather pictures.

NEW! JIL SX-200

CE price \$269.00/NEW LOW PRICE
8-Band, 16 Channel • No-crystal scanner
Quartz Clock • AM/FM • AC/DC
Bands: 26-88, 108-180, 380-514 MHz

Tune Military, F.B.I., Space Satellites, Police & Fire, D.E.A., Defense Department, Aeronautical AM band, Aero Navigation Band, Fish & Game, Immigration, Paramedics, Amateur Radio, Justice Department, State Department, plus thousands of other restricted radio frequencies not other scanner is programmed to pick up.

NEW! JIL SX-100

CE price \$134.00/NEW LOW PRICE
6-Band, 16 Channel • Crystalless • AC/DC
Frequency range: 30-54, 140-174, 410-514 MHz. The JIL SX-100 scanner is a mobile keyboard programmable scanner that puts you in the seat of the action at home or in your car. Compact and good looking, the SX-100 even gives you the time and date. It's small size will easily fit in most domestic or foreign cars and it's AC/DC adaptable for home use.

Regency® HX1000

Allow 90-180 days for delivery after receipt of order due to the high demand for this product. List price \$329.95/CE price \$209.00

6-Band, 20 Channel • No Crystal scanner
Search • Lockout • Priority • Scan delay
Sidelit liquid crystal display

Frequency range: 30-50, 144-174, 440-512 MHz. The new handheld Regency HX1000 scanner is fully keyboard programmable for the ultimate in versatility. You can scan up to 20 channels at the same time. When you activate the priority control, you automatically override all other calls to listen to your favorite frequency. The LCD display is even sidelit for night use. A die-cast aluminum chassis makes this the most rugged and durable hand-held scanner available. There is even a backup lithium battery to maintain memory for two years. Includes wall charger, carrying case, belt clip, flexible antenna and nicad battery. Reserve your Regency HX1000 now.

Regency® R106

List price \$149.95/CE price \$99.00
5-Band, 10 Channel • Crystal scanner • AC/DC
Frequency range: 30-50, 146-174, 450-512 MHz

A versatile scanner, The Regency R-106 is built to provide maximum reception at home or on the road. Rugged cabinet protects the advanced design circuitry allowing you years of dependable listening.

NEW! Regency® D810

List price \$399.95/CE price \$259.00
8-Band, 50 Channel • Crystalless • AC only
Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz

This scanner offers Public service bands, plus Aircraft and FM broadcast stations. You can listen to Bach or a Boeing 747, the Rolling Stones or the riot squad, or any of 50 channels. Plus special direct access keys let you listen to police, fire, emergency, or any of your favorite channels just by pushing a button.

Regency® R1040

List price \$199.95/CE price \$129.00
6-Band, 10 Channel • Crystalless • AC only
Frequency range: 30-50, 144-174, 440-512 MHz

Now you can enjoy computerized scanner versatility at a price that's less than some crystal units. The Regency R1040 lets you in on all the action of police, fire, weather, and emergency calls. You'll even hear mobile telephones.

Programming the R1040 is easy. Merely touch the keyboard and enter any of over 15,000 frequencies on your choice of 10 channels.

TEST ANY SCANNER

Test any scanner purchased from Communications Electronics™ for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

OTHER RADIOS & ACCESSORIES

Regency® C403 Scanner.....	\$59.00
NEW! Panasonic RF-B50 Shortwave receiver.....	\$129.00
Panasonic RF-9 Shortwave receiver.....	\$84.00
Panasonic RF-799 Shortwave receiver.....	\$219.00
Panasonic RF-2600 Shortwave receiver.....	\$199.00
Panasonic RF-2900 Shortwave receiver.....	\$249.00
Panasonic RF-3100 Shortwave receiver.....	\$269.00
Panasonic RF-6300 Shortwave receiver.....	\$539.00
NEW! Bearcat® 151 Scanner.....	\$169.00
NEW! Bearcat® Five-Six Scanner.....	\$129.00
Bearcat® 300 Scanner.....	\$349.00
Bearcat® 250 Scanner.....	\$279.00
Bearcat® 200 Scanner.....	\$189.00
Bearcat® 210 XL Scanner.....	\$229.00
Bearcat® 20/20 Scanner.....	\$289.00
Bearcat® 100 Scanner.....	\$289.00
Bearcat® Weather Alert.....	\$49.00
Freedom Phone® 4000 Cordless telephone.....	\$239.00
Fanon FCT-200 Cordless telephone.....	\$139.00
Fanon 6-HLU Scanner.....	\$99.00
CHB-6 Fanon AC Adapter/Battery Charger.....	\$15.00
CAT-6 Fanon carrying case with belt clip.....	\$15.00
SP55 Carrying case for Bearcat Five-Six.....	\$15.00
MA-506 Carrying case for Regency HX650.....	\$15.00
SCMA-6 Fanon Mobile Charger/Audio Amplifier.....	\$49.00
AUC-3 Fanon auto lighter adapter/Battery Charger.....	\$15.00
FB-E Frequency Directory for Eastern U.S.A.....	\$12.00
FB-W Frequency Directory for Western U.S.A.....	\$12.00
TSG "Top Secret" Registry of U.S. Government Freq.....	\$15.00
RRF Railroad Frequency Directory.....	\$10.00
ESD Energy Services Directory.....	\$10.00
ASD Frequency Directory for Aircraft Band.....	\$10.00
SRF Survival Radio Frequency Directory.....	\$10.00
TIC Techniques for Intercepting Comm. Manual.....	\$12.00
CIE Covert Intelligence, Elect. Eavesdropping Man.....	\$12.00
B-4 1.2 V AAA Ni-Cad batteries (set of four).....	\$9.00
B-6 1.2 V AA Ni-Cad batteries (set of four).....	\$12.00
A-135C Crystal certificate.....	\$3.00
Add \$3.00 shipping for all accessories ordered at the same time.	
Add \$12.00 per shortwave receiver for U.P.S. shipping.	

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have a base and a mobile antenna specifically designed for receiving all bands. Order #A60 is a magnet mount mobile antenna and order #A70 is an all band base station antenna. Price is \$35.00 each plus \$3.00 for UPS shipping in the continental United States.

BUY WITH CONFIDENCE

To get the fastest delivery from CE of any scanner, send or phone your order directly to our Scanner Distribution Center. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 30% surcharge for net 30 billing. All sales are subject to availability, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on back-order automatically unless CE is instructed differently. Minimum prepaid order \$35.00. Minimum purchase order \$200.00. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

Mail orders to: Communications Electronics™, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$7.00 per scanner for U.P.S. ground shipping and handling in the continental U.S.A. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-521-4414. In Canada, order toll-free by calling 800-265-4828. Telex anytime 810-223-2422. If you are outside the U.S. or in Michigan dial 313-973-8888. Order today.

Scanner Distribution Center™ and CE logos are trademarks of Communications Electronics™.

† Bearcat is a federally registered trademark of Electra Company, a Division of Masco Corporation of Indiana.
‡ Regency is a federally registered trademark of Regency Electronics Inc.

AD #092683

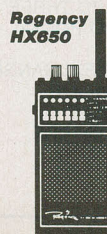
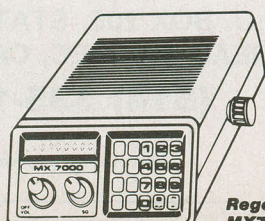
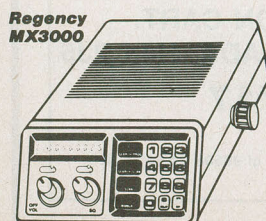
Copyright ©1983 Communications Electronics

Order Toll Free ... call
1-800-521-4414

**COMMUNICATIONS
ELECTRONICS™**

Consumer Products Division

818 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.
Call toll-free 800-521-4414 or outside U.S.A. 313-973-8888



SPECIAL FEATURE

- 51 **ELECTRONIC INNOVATIONS**
A look at those products that do just about anything you can think of, and probably a few things that you never even thought of. **Warren Roy**

- 59 **UNIQUE TEST EQUIPMENT**
What's new and unusual in electronic test equipment. **Chester H. Lawrence**

BUILD THIS

- 45 **HI-FI SOUND CONVERTER FOR YOUR TV**
Get sound quality you never dreamed possible with this easy-to-build, easy-to-install project. **Gary McClellan**
- 69 **VOICE-OPERATED SWITCH FOR YOUR TAPE RECORDER**
Get "hands-off" operation for your tape recorder with this simple yet effective device. **James P. Reed**
- 75 **MINI PLAYER-PIANO**
Part 3. How to use this fascinating conversation piece. **Robert Grossblatt**

TECHNOLOGY

- 4 **VIDEO ELECTRONICS**
Tomorrow's news and technology in this quickly changing industry. **David Lachenbruch**
- 10 **SATELLITE/TELETEXT NEWS**
The latest happenings in communications technology. **Gary H. Arlen**
- 12 **VIDEOGAMES**
Staying power. **Danny Goodman**

CIRCUITS AND COMPONENTS

- 65 **ECL LOGIC CIRCUITS**
Part 2. More on how to use this logic family. **TJ Byers**
- 101 **NEW IDEAS**
An award-winning project from one of our readers.
- 102 **HOBBY CORNER**
A Lotto selector. **Earl "Doc" Savage, K4SDS**
- 104 **DRAWING BOARD**
Working with counters. **Robert Grossblatt**
- 106 **STATE OF SOLID STATE**
A power transistor driver/amplifier. **Robert F. Scott**

AUDIO

- 83 **AUDIO TAPES: HOW DIFFERENT ARE THEY?**
A look at how different brands of audio tape differ, and how they are the same. **Herb Friedman**

VIDEO

- 110 **SERVICE CLINIC**
Full-wave bridge rectifiers. **Jack Darr**
- 111 **SERVICE QUESTIONS**
Radio-Electronics' Service Editor solves technicians' problems.

RADIO

- 114 **COMMUNICATIONS CORNER**
A computer-controlled antenna tuner. **Herb Friedman**

COMPUTERS

- 79 **WORD PROCESSING**
The ins and outs of word processing. **Herb Friedman**
- 108 **COMPUTER CORNER**
Computer graphics. **Les Spindle**

EQUIPMENT REPORTS

- 26 **Phoenix Audio Laboratory Loftech TS-1 Audio Test Set**
- 38 **Fluke Model 77 DMM**
- 42 **Heathkit EE3104 Electronics Circuits Course**

DEPARTMENTS

- | | |
|---------------------------------|--------------------|
| 8 Advertising and Sales Offices | 118 New Books |
| 156 Advertising Index | 124 New Literature |
| 157 Free Information Card | 112 New Products |
| 21 Letters | 6 What's News |
| 120 Market Center | |

ON THE COVER

When you think about the products in the various different categories of electronic products—be they video, audio, broadcast, or what have you—there are always some that shine above the rest. The reason why they are thought of as superior may be due to a sophisticated design, the use of state-of-the-art technology, better reliability or accuracy, or any one of a number of similar reasons. The same holds true, of course, for test instruments. This month we bring you a special look at the ultimate in sophisticated or unusual test instruments. The story begins on page 59.



FEW PEOPLE REALIZE that the quality of your TV sound is limited only by the quality of your TV's audio section. Unfortunately, the quality of the audio in an average set is just not very good. But there is something you can do about it—build the TV sound converter and get audio quality you never thought possible from your TV. The story starts on page 45.

COMING NEXT MONTH

On Sale November 17

- **Video Color Processor.** An accessory you can build for your home-video system.
- **Digital TV.** A look at this fascinating new technology.
- **Designing Analog Circuits.** Another installment in our back-to-school series.
- **And lots more!**

Radio-Electronics, (ISSN 0033-7862) Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Second-Class Postage Paid at New York, N.Y. and additional mailing offices. One-year subscription rate: U.S.A. and U.S. possessions, \$14.97, Canada, \$17.97. Other countries, \$22.47 (cash orders only, payable in U.S.A. currency). Single copies \$1.50. © 1983 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

Subscription Service: Mail all subscription orders, changes, correspondence and Postmaster Notices of undelivered copies (Form 3579) to Radio-Electronics Subscription Service, Box 2520, Boulder, CO 80322.

A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.

As a service to readers, Radio-Electronics publishes available plans or information relating to newsworthy products, techniques and scientific and technological developments. Because of possible variances in the quality and condition of materials and workmanship used by readers, Radio-Electronics disclaims any responsibility for the safe and proper functioning of reader-built projects based upon or from plans or information published in this magazine.

VIDEO ELECTRONICS

DAVID LACHENBRUCH
CONTRIBUTING EDITOR

HI-FI VHS

The 10 Japanese manufacturers of VHS videocassette recorders have agreed on specs for a helical-scan audio track to compete with Beta Hi-Fi. The major point of disagreement had been on noise-reduction systems, and the one finally selected is a newly developed one which is said to most closely resemble dbx. The Hi-Fi VHS system uses a process called "depth multiplex recording" and uses a supplementary pair of audio heads, unlike Beta Hi-Fi, which uses the video heads to pick up an FM signal that is multiplexed into the video information. In the VHS version, FM audio signals (on a 1.3 MHz carrier for the left, 1.7 MHz for the right) are recorded on the tape by the rotary heads, and then the video material is recorded over the audio signal on the same portion of the tape, but closer to the surface of the magnetic material. The announced specs of Hi-Fi VHS are similar to the previously announced ones of Beta Hi-Fi—80-dB dynamic range, frequency response of 20-20,000 Hz, distortion 0.3%, wow and flutter virtually nonexistent.

To preserve compatibility, the longitudinal audio track will be maintained. That track in some machines, including the new VHS Hi-Fi models, is already a stereo track, so the new units to be available here in early to mid-1984 will be capable of having four separate audio tracks as well as two stereo audio track systems. Quad VCR, anyone?

BACKTALKING VCR

Look for a VCR that talks to you among next year's introductions. A feminine synthesized voice will remind you to insert the cassette, warn you if the safety tab has been removed on the cassette you want to record, summarize the date and time for which your machine is programmed, tell you if you've goofed when you set the timer for two overlapping programs—and praise you when you've done everything right. It's already been introduced in Japan by Sony, and is on the way across the pond, we're afraid.

TV STEREO SOUND

The FCC has finally opened its long-anticipated proceeding that will end with the authorization of multi-channel sound for television, including stereo. In line with its current laissez-faire policies, the Commission proposed merely to remove all restrictions on the use of the aural subcarriers in the TV broadcast band, permitting stations to use them for virtually any purpose, paralleling a recent similar "deregulation" of FM station subcarriers. The FCC also proposed to widen TV's aural track from 75 to 120 kHz and increase permissible modulation from 25 to 75 kHz.

Mindful of the stalemate that followed the FCC's ruling on AM stereo, which established no standards, the broadcasting, set-manufacturing, and cable-TV industries have continued testing of three proposed multi-channel TV sound systems through a special industry-wide EIA committee, with the hope that the recommended system will become the *de facto* standard for stereo sound broadcasting.

The tests of multichannel sound systems developed by Electronics Industry of Japan, Telesonics Corp., and Zenith Radio Co. were nearing completion at press time, and the committee's chairman, Thomas Keller of the National Association of Broadcasters said all of the systems tested well and all were "superior in quality to FM radio." He also minimized the chances that any problems might be experienced by cable TV systems in connection with stereophonic TV sound.

Each of the three systems permits the broadcasting of stereophonic sound along with another channel of audio, so that a station or network might broadcast a simultaneous translation of the audio into another language without sacrificing stereo on the English-language soundtrack.

TV set makers, meanwhile, were preparing for the advent of stereo by developing circuits for all three proposed systems. It is believed that the earliest the FCC could finalize its ruling legitimizing multi-channel TV sound would be in February 1984—and it could take much longer if there are any legal complications. Multi-channel broadcasting could start within a few months and TV sets could be tooled, manufactured and on sale about five months after the FCC acts—meaning that stereo TV receivers could be on the market in the summer of 1984.

With a stereo-audio track and a supplementary sound channel available, it's only a matter of time before somebody adds a subsubcarrier to the supplementary channel. Quad TV, anyone?

R-E



Sleep Sheep

We may have found a way to improve your sleep forever.

New Zealanders discovered that sleeping under sheep's wool induced sleep.

The story we are about to tell you may seem rather incredible. And indeed it is. But if you'll have an open mind, what you will learn may indeed change your life.

There is a new product manufactured in New Zealand that is selling very well. It's called the Woolrest—a bed pad made of thick wool. You simply place it over your mattress and then cover it with your bottom sheet as you normally do when you make your bed.

SLEEP INDUCING

Sheep's wool has always had an outstanding reputation for keeping you warm in winter and cool in summer. That is why wool seat covers are so popular. But wool has another property known by New Zealanders for many years. Namely—wool induces sleep.

In New Zealand, for example, a way to cure insomnia was to cover yourself with a sheepskin rug. For some very unscientific reason, the hypnotic quality of the wool encouraged sleep. Counting sheep was another technique that was often recommended. But it was the development of the Woolrest bed pad that suddenly turned an old wife's tale into fact.

DIFFERENT EXPERIENCE

Sleeping on a Woolrest is a different sleeping experience. Whether you sleep on a hard or soft mattress, the Woolrest apparently radiates a feeling of comfort and relaxation from the wool fibers which mold, massage, and conform to your entire body.

Scientific tests conducted by Dr. Peter Dickson of Ohio State University proved that the Woolrest pad indeed helped induce sleep. Testimonials from people who owned them clearly demonstrated that Woolrest not only induced sleep but also provided great relief for backaches, arthritis, and rheumatism. Its natural fibers tend to alleviate the pain and pressure caused by these illnesses and thus make sleep come easier and deeper.

Frank Thornton, a Seattle Washington dental technician, had trouble sleeping for six years. He purchased a Woolrest pad and has

been able to sleep through the entire night practically every night. According to Thornton, "I felt a sensation of buoyancy from the Woolrest. I have read in literature that a person sleeps more restfully with natural fibers surrounding their body." Thornton has already purchased seven Woolrest pads for his entire family.

There are hundreds of other testimonials we could mention from the thousands who have purchased them, but one thing is clear. Using a Woolrest pad you know that the rest of your life will be spent sleeping comfortably, with a minimum amount of sleeplessness. Certainly, there will be nights when it will be difficult to go to sleep. But with the Woolrest those nights will be fewer, shorter and without the tradeoff of taking sleep-inducing drugs.

WARM IN WINTER

In the winter the Woolrest holds your body heat and thus keeps you warmer. You'd expect that. But in summer it keeps you cooler through a process of moisture absorption by absorbing up to one-third of its weight in moisture to keep your body cool and dry.

Will the Woolrest work for you? We're willing to prove it with no risk on your part. Order one for a 45-day sleep test. When you receive it, closely examine the surface. Feel the thick pure woven pile of natural New Zealand wool. Place it on your bed and then cover the pad with your regular bottom bed sheet—either fitted or plain.

JUST A FEW DAYS

That night go to sleep on it. But don't judge the effectiveness until you've slept on it for at least a full month. You should actually notice the difference in just a few days, but after a month you'll turn from being skeptical like we were, to a real enthusiastic believer. If not, we'll understand. After all it may not work for everybody. Just return it within the 45-day sleep trial and you'll receive a prompt and courteous refund including the \$4 delivery charge. The Woolrest washes easily

in your washing machine and has a limited five-year warranty. Complete instructions come with each pad. Sleep on a Woolrest and experience what we mean at no risk or obligation. Order one, today.

To order, credit card holders call toll free and ask for product by number below or send check plus \$4 delivery for each pad ordered.

Twin Size (0025RA)	\$129
Full Size (0026RA)	179
Queen Size (0027RA)	209
King Size (0028RA)	269

The New Zealand wool used exclusively in the Woolrest could be a major reason for its effectiveness. Here's why.

Most sheep are raised in countries where temperature extremes cause their wool fibers to become brittle, rigid and often cracked at the ends. In Australia sheep are often raised in the dusty outback where temperature and rainfall can vary greatly.

In New Zealand however, the sheep enjoy a year-round temperate climate and graze in lush green pastures. Their wool fibers are thick and vibrant with good shape retention.

NEW ZEALAND WOOL

The Woolrest uses only the best New Zealand wool. The fibers are actually woven onto a pure wool blanket base and thoroughly washed and tufted.

We have mentioned the importance of New Zealand wool for good reason. Just as there are several grades of sheepskin seat covers, we suspect eventually there will be several grades of wool bed pads. None will ever compare to the wool used in the Woolrest.

JS&A®

One JS&A Plaza
Northbrook, Illinois 60062

CALL TOLL FREE 800 323-6400
IL residents add 6% sales tax. ©JS&A Group, Inc., 1983

WHAT'S NEWS

Electricity plus gas in experimental car

A new "hybrid" car with both an electric motor and a gasoline engine has been developed by General Electric for the U.S. Department of Energy. The new propulsion system gives the experimental vehicle the fuel savings of an electric for around-town driving, while eliminating the electric's major drawback—its limited driving range. It uses batteries for short-range driving, and can make long—even cross-country—trips with the gas engine.

The electric motor is powered by ten 12-volt lead-acid batteries that weigh a total of 750 lbs. The battery may be recharged by the gasoline engine or by wall-plug electricity. The car is also equipped with a regenerative braking system that feeds recharge energy to the batteries when the brakes are applied.

The 40-HP electric motor and the 80-HP gas engine operate separately or in parallel. Electricity is used for speeds up to 40 mph, and gas for highway driving.

The Hybrid Test Vehicle was built by a team of automotive and technology firms headed by scientists and engineers of the GE Research and Development Center, Schenectady, NY. GE developed and

built the car's 40-horsepower electric motor, the electronic controls for the motor, and the microcomputer that controls the entire hybrid system, monitors the battery's state-of-charge and a variety of other parameters, and decides when to switch on the electric motor, the gasoline engine, or both.

The total cost of the development effort—including the efforts of various subcontractors—was \$10 million.

Videodisc owners are using their discs

A survey conducted by RCA indicates that the average videodisc owner uses his player 8.5 hours every week, and watches his favorite programs repeatedly. Households with children use their players 10.3 hours a week on the average.

Cable TV does not appear to be a competitor—videodisc owners who subscribe to Home Box Office use their players 8.8 hours a week. (Persons who use two services apparently watch more video than the average.) That also seems to apply to VCR owners, who use their videodisc players an average of 7.9 hours a week.

The survey also discovered that

about 80 percent of videodisc owners who also subscribe to cable TV were already on cable when they bought their videodisc players.

Ku-band satellites for direct home broadcast

Contracts are being let for a fully developed Direct Broadcast Satellite (DBS) system that will cover the United States with four operating satellites and two in-orbit spares. Larry Yermak, Director of satellite programs at RCA Astro-Electronics in Princeton, NJ, told a ku-band satellite communications conference at Washington, DC, that the system is being designed for General Telephone & Electronics (GTE) and its GSTAR program.

Each of the four satellites, transmitting in the 14/12 GHz band, will transmit data, voice, and images, to the 48 continental United States on 16 channels by shaped beam. Alaska and Hawaii will be covered by spot beams.

New component series tailored for customer

Six "firsts" are claimed by the manufacturer of a remote-controlled tuner designed to match components in a product series tailored to individual consumer needs. The firsts are in a high-technology microcomputer-controlled FM frequency synthesizer in the B261 tuner by Revox of Switzerland.

To suit the individual purchaser, the Revox retailer will program the frequency and call letters for each of the tuner's 20-station presets. He will also program into the tuner's memory each of four modes (stereo, high blend, mono, and muting). All programmed controls will then be covered with a tinted plexiglass shield to protect the programmed settings.

Other firsts include tuning in 12.5-kHz increments, an alphanumeric liquid-crystal display with seven numbers for station frequency, and four letters or numbers for station name; memory locations for up to 20 FM station frequencies, with corresponding station identification; direct automatic memory scan through the 20 stations, or scan via remote con-

trol; optional second antenna input, with potential to assign the desired antenna to any station frequency, and a 400-Hz calibration oscillator that permits precise level setting of a connected tape recorder. Expanded use of microprocessors makes possible an infrared remote-control system that covers all switching and control functions of the tuner.

The B261 is engineered to match Revox's new B251 integrated amplifier. The optional remote control will operate the B261 and the B251 individually, and (with adapters) two turntables, a cassette recorder, and an open reel deck not in the B200 series. The manufacturer's suggested retail price is \$1,500.

New AM stereo tuners play all four systems

Two manufacturers have designed AM-stereo tuners that can receive any one of the four systems currently in use under the FCC's "let the market decide" approach to AM stereo.

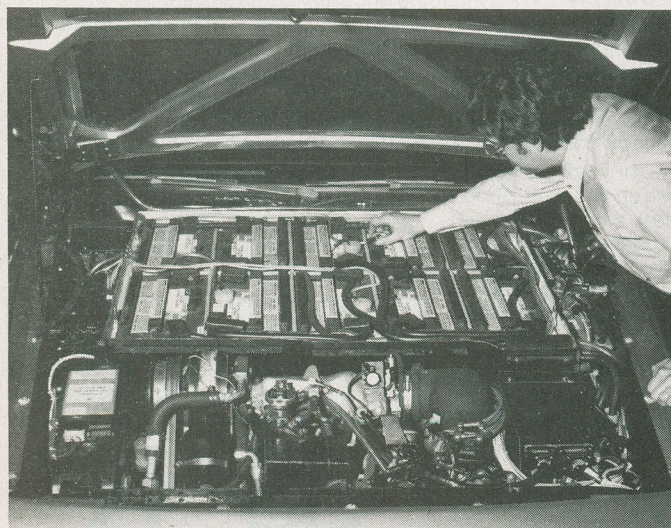
The system developed by the Japanese company Sansui actually senses which of the four stereo systems is being used by the station to which it is tuned, and immediately starts decoding it.

Sansui is developing two types of tuners. One is a car radio, which the company says will be available at a price of around \$200. The other, an AM/FM/stereo tabletop tuner, is expected to sell for \$410. Both are based on a multisystem IC that Sansui says it may make available to other manufacturers.

The other manufacturer, Sony, is expected to have a tuner available shortly. A portable AM/FM stereo type, its price will be around \$90. The Sony model uses a switch to select the competing systems—one position for Kahn AM-stereo, a second position for Magnavox, Motorola and Harris.

The new multisystem tuners are expected to speed up the adoption of AM stereo, since many potential customers now hesitate to buy a tuner that would not be able to receive some of the important stations that may go over to AM stereo in the future. Stations will also be

continued on page 8



A LOOK UNDER THE HOOD of the experimental "hybrid" electric-gas vehicle developed by General Electric for the Department of Energy shows its stack of lead-acid batteries. Running on electricity for in-town driving, and on gas for the road, it combines the economy and anti-pollution advantages of electric vehicles with the long-range driving advantage of the gasoline engine car.

Now 60 MHz or 100 MHz Tek quality is just a free phone call away!



New lower price!
100 MHz 2235
now just \$1650.

Tek has expanded its best-selling 2200 scope line up to 100 MHz. And brought it all as close as your phone. Tek's revolutionary, reduced-component architecture brings unprecedented quality, reliability and affordability to the 60 MHz 2213 and 2215, and now, the 100 MHz 2235.

All three of these lightweight (13.5 lb.) scopes feature 2 mV/div vertical sensitivity and 5 ns/div sweep speeds, plus a complete trigger system for stable triggering on digital, analog or video waveforms.

Scopes with a comprehensive 3-year warranty*... probes...and expert advice. One free call gets it all! You can order, or obtain literature, through the Tek National

	2213	2215	2235
Bandwidth	60 MHz	60 MHz	100 MHz
No. of Channels	2	2	2 + Trigger View
Alternate Sweep	—	Yes	Yes
Vert/Trig B/W Limit	—	—	Yes—20 MHz
Single Sweep	—	—	Yes
Accuracy: Vert/Horz	3%	3%	2%
Delay Jitter	1:5,000	1:10,000	1:20,000
Trigger'g Sensitivity	0.4 div at 2 MHz	0.4 div at 2 MHz	0.3 div at 10 MHz
Input R-C	1M Ω —30pf	1M Ω —30pf	1M Ω —20pf
Variable Holdoff	4:1	4:1	10:1
Price	\$1200†	\$1450†	\$1950† Now \$1650†

Marketing Center. Technical personnel, expert in scope applications, will answer your questions and expedite delivery. Direct orders include operating and service manuals, two 10X probes, 15-day return policy, and worldwide service back-up.

Order toll free:
1-800-426-2200,
Extension 61.

In Oregon call collect:
(503) 627-9000, Ext. 61.

†Price F.O.B. Beaverton, OR.
*3-year warranty includes CRT and applies to 2000 family oscilloscopes purchased after 1/1/83.
Scopes are UL Listed, CSA and VDE approved.

Tektronix
COMMITTED TO EXCELLENCE

WHAT'S NEWS

continued from page 6

more ready to convert, if they know that listeners will be able to receive them, no matter which system they adopt.

The systems, however, are competing fiercely to become the "accepted" one. At the time of writing, Harris appeared to be the leader, claiming to be equipping 15 to 20 stations a month. The Kahn system has more than 30 stations on the air, Motorola six, and Magnavox 3.

First-run films to be transmitted while subscriber sleeps

In a program already in use experimentally, subscribers to a service known as TeleFirst will be able to receive first-run films transmitted by local broadcast stations direct to their home videocassette recorders.

TeleFirst, an electronic service from ABC, transmits during the early morning, usually between 3 and 5 A.M. (very few ABC stations broadcast 24 hours a day). According to an ABC official "You set your VCR before you go to bed, and when you wake up you will have a brand-new first-run film ready for you on your cassette.

The film will *not* be ready for non-subscribers to the TeleFirst service—it is in scrambled form. All subscribers receive a decoder, for a fee expected to run about \$25 per month. That decoder attaches to the viewer's recorder and makes the recordings viewable.

Commercial service will begin early in 1984, with WLS, the ABC affiliate in Chicago, as the first station to transmit the films.

EIA debates system for multichannel TV sound

The Electronic Industries Association (Consumer Electronics Group) reported in August that the EIA Multichannel Sound Committee was completing the testing phase, leading to a vote on what system of multichannel TV sound to recommend to the FCC.

Testing the three proposed transmission systems at Matsushita had been finished, and testing the four proposed companding systems was practically completed. A combined transmis-

sion-companding test, scheduled for this past September, would complete the technical record.

It was expected that a complete report and industry recommendation for a single transmission and companding system would be ready to present by mid-December, to meet the FCC's schedules for decision making.

New information system keeps motorists updated

Blaupunkt reports that as of last August its Automatic Radio Information (ARI) service was covering the New York metropolitan area with four widely separated FM stations, and began serving Connecticut and Philadelphia during September. ARI is Blaupunkt's subcarrier technology that enables selected FM radio stations to provide motorists with timely traffic bulletins for specific "travel zones" within a metropolitan area.

Blaupunkt also announced that it has added to its line an adaptor, the ARI-A, which can convert any "ARI-capable" FM receiver into a functioning ARI-receiving instrument. (All Blaupunkt radios now being imported are ARI-capable.) The adaptor plugs into the back of the ARI-capable electronically tuned unit and provides pushbutton "travel-zone" selection. When the zone is selected, the radio will scan to the station for that zone, ignoring all other stations.

"Amorphous metal" for future transformers?

A new kind of core material, "amorphous metal," has the potential of eliminating more than a half-billion dollars a year energy waste in power transformers, say General Electric scientists. G. E. is now engaged—with the support of electric power organizations—in a \$6.6 million program designed to make that core material commercially practical.

Amorphous metal is a fundamentally new kind of material, in which the orderly, crystalline atomic structure of metals and alloys is totally absent. The material's atoms and molecules are arranged randomly—much as they are in

glass. (The material is also known as "glassy metal" or "metallic glass.")

The amorphous composition is much easier to magnetize than materials now used for transformer cores; thus core losses are reduced (by about 70 percent) resulting in great savings.

Amorphous metal is made by ultra-fast cooling. The molten iron-based alloy (at about 2,300° F) is squirted onto a cool (60° F) rapidly spinning wheel, where it hardens in about a thousandth of a second into a thin (.001-inch) ribbon. The ultra-fast action freezes the material before it has time to assume the ordered structure of metals.

The present program is aimed at accelerating the commercialization of transformers with those cores. Some major manufacturing challenges will have to be met before they can be mass-produced at low cost.

Meanwhile G.E. has produced 25 "pre-prototype" transformers, which are being installed in key utility systems as part of a long-time evaluation program. Within the next 39 months 1,000 25 KVA transformers will be delivered for field testing by sponsoring utilities.

New European satellite studies future physics

The European space satellite, EXOSTAT, is ready to commence its task after a series of calibration maneuvers to fix its position in space, Marconi Space & Defense Systems reported in July. The long-term pointing accuracies, according to Marconi, who built the attitude control system, are around 1.5 arc second rms, which is about twice the accuracy capability of the observing instruments on board.

The satellite will now observe pulsars, supernovas, quasi-stellar bodies, and collapsed stars in the attempt to learn more about the laws of physics that apply under the strange conditions found in those celestial objects.

The precise timing of the launch, EXOSAT's ability to modify its own orbit, plus the low gas consumption rate of the attitude-control system, gives reason to hope that the satellite's useful life can be extended well beyond the planned two-year mission.

Radio-Electronics

Hugo Gernsback (1884-1967) founder

M. Harvey Gernsback, editor-in-chief

Larry Steckler, CET, publisher

Arthur Kleiman, editor

Carl Laron, WB2SLR, associate editor

Brian C. Fenton, assistant editor

Jack Darr, CET, service editor

Robert F. Scott, semiconductor editor

Herb Friedman, communications editor

Gary H. Arlen, contributing editor

David Lachenbruch, contributing editor

Earl "Doc" Savage, K4SDS, hobby editor

Danny Goodman, contributing editor

Dan Rosenbloom, production manager

Robert A. W. Lowndes, production associate

Dianne Osias, production assistant

Joan Roman, circulation director

Arline R. Fishman, advertising coordinator

Cover photo by Robert Lewis

Radio-Electronics is indexed in *Applied Science & Technology Index* and *Readers Guide to Periodical Literature*.

Gernsback Publications, Inc.
200 Park Ave. South
New York, NY 10003

President: M. Harvey Gernsback
Vice President: Larry Steckler

ADVERTISING SALES 212-777-6400

Larry Steckler
Publisher

EAST/SOUTHEAST

Stanley Levitan
Radio-Electronics
200 Park Ave. South
New York, NY 10003
212-777-6400

MIDWEST/Texas/Arkansas/Okla.

Ralph Bergen
Radio-Electronics
540 Frontage Road Suite 325
Northfield, Illinois 60093
312-446-1444

PACIFIC COAST Mountain States

Marvin Green
Radio-Electronics
413 So. La Brea Ave.
Los Angeles, Ca 90036
213-938-0166-7



Amazing new solid-state oscilloscope... fits in the palm of your hand

CRT oscilloscopes just became obsolete! The revolutionary new solid-state digital LED Pocket-O-Scope does it all, in a 4-ounce package you can put in your pocket.

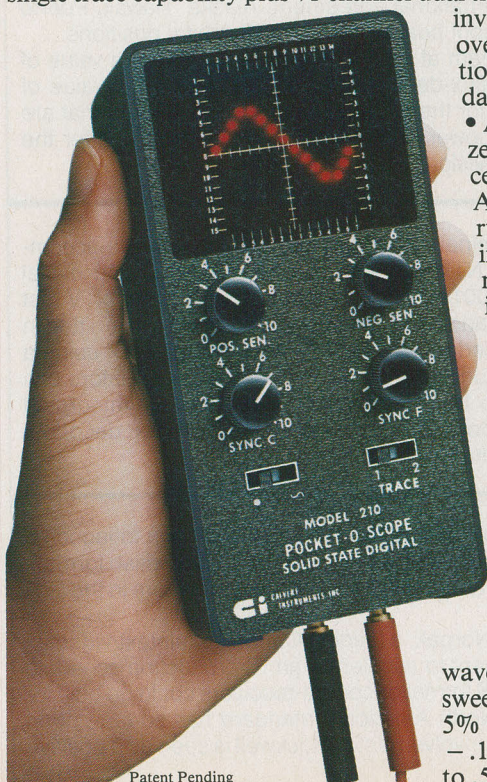
Easy to use. Ideal for the hobbyist or the technician. The Pocket-O-Scope is 100% solid-state, focus and brightness on the 210 point, high-intensity illuminated screen are *electronically* self-controlled. The trace is *always* in sharp focus. Zero and sweep positions are maintained automatically. Zero-reference, or cross-over line is always centered for full trace minimum on the screen. Automatic internal circuitry always assures a properly positioned wave form. **4 solid-state controls do it all.** The only knobs on the Pocket-O-Scope are for positive and negative sensitivity and for coarse and fine synchronization of the frequency of the incoming signal. The easiest to use, full capability scope available!

Years in development. The Pocket-O-Scope is the culmination of years of development in high technology, micro-electronic components and digital design.

Features: All solid-state, digital design • Hand-held or bench operation • High resolution 210 point, 1.5" square display • Battery or A/C operation with adapter • Factory calibrated — *never requires recalibration* • Full function, single trace capability plus 1/2 channel dual trace and signal inverter • Full overload protection to prevent damage to scope

• Automatic zero voltage centering • Automatic free run or locked image • Automatic full horizontal sweep circuit • External input/output for add-on capability

Specifications:
5 Megahertz bandwidth • Sensitivity — vertical, 10MV • Accuracy ± 3% on wave forms — sweep linearity ± 5% • Time base — .1 microseconds to .5 seconds



Patent Pending

• Vertical gain — 0 to 120 volts • Continuous free run to locked image response • Power supply 9VDC — dual polarity **Controls:** Single or dual trace • On-off, battery-A/C • Sensitivity; separate pos. & neg. controls • Sync C & Sync F controls

Limited, 90-day warranty

No risk introductory offer. The revolutionary Pocket-O-Scope is a development of Calvert Instruments, Inc., for 25 years a manufacturer of electrical equipment. As an introductory offer for a limited time only, you can buy the Pocket-O-Scope including a carrying case, A/C adapter, 3 standard "grabber" probes and 2 high voltage probes for only \$249.95, a \$321 value. If you act now, you will also receive FREE Calvert's 200-page Comprehensive Oscilloscope Training Manual, a \$15.95 value!

Put your Pocket-O-Scope to the test for two weeks. And if you decide, for *any* reason, that the Pocket-O-Scope is not for you, return it within the 14-day trial period for a prompt refund. The training manual will still be yours to keep.



Mail this coupon today, or call toll-free* while the introductory offer is still in effect.

Calvert Instruments, Inc.

19851 Ingersoll Dr., Cleveland OH 44116 • 216-356-2155

Please send me:

____ Pocket-O-Scope(s), including carrying case, A/C adapter, standard and high voltage probes, and FREE training manual. (Batteries not included) all for \$249.95 plus \$5 for postage and insurance. Ohio residents add 6.5% sales tax.
____ Pocket-O-Scope only with standard probes: \$179.95 plus \$5 postage. Ohio Residents add 6.5% sales tax.

☐ My check is enclosed.

☐ Please charge the credit card account checked below. (Fill in all account number digits of the *one* credit card you wish to use.) RE- 1183

☐ MasterCard ☐ Visa

Expiration Date _____ Interbank No. _____ (MasterCard only)

Full signature _____

Name _____ (please print)

Address _____ Apt. _____

City _____

State _____ Zip _____

*CALL TOLL-FREE 800-835-2246 EXT. 118 to order by phone, request further information or to inquire about becoming a distributor. In Kansas, call 800-362-2421 Ext. 118. Allow 6-8 weeks for delivery.

CIRCLE 7 ON FREE INFORMATION CARD

SATELLITE/TELETEXT NEWS

GARY ARLEN
CONTRIBUTING EDITOR

DBS SERVICE IN 1984

Satellite Television Corp. has advanced its Direct Broadcasting Satellite timetable, and now intends to begin a five-channel pay-TV service in fall 1984—nearly two years ahead of the original plan. STC's first DBS transmissions will be available only in the northeast US and will be sent via a new Satellite Business Systems bird. SBS (partly owned by STC's parent company, Comsat) will modify the SBS-4 satellite now under construction to permit signals from five transponders to be concentrated in the densely populated northeastern US. STC expects that dishes as small as two-feet in diameter can be used for its DBS feeds.

NBC TRANSMISSIONS

The NBC television network is also going aloft on a specially modified Satellite Business System Ku-band bird, starting January 2. Comsat General Corp. will actually manage the service, which calls for a satellite communications system that will initially distribute programming to 24 NBC affiliate stations. The contract is seen as the first step toward a 10-year agreement by which Comsat will provide satellite network distribution to all NBC affiliates in the US. The space segment of the NBC transmission will travel on SBS Ku-band satellites, although in the future the service will be moved to RCA Americom birds operating at the same frequency.

U.S. GETS 8 DBS SLOTS

The western hemisphere satellite conference has sorted out orbital assignments for Direct Broadcasting Satellite service (12 GHz band), and the US has received eight positions with authority to transmit 32 channels from each slot. The assignments are at 175°, 166°, 157°, 148°, 119°, 110°, 101°, and 61.5° (all west longitude). The US delegation to the 23-nation Regional Administrative Radio Conference (RARC) had hoped to obtain enough slots to provide service to four areas within the continental US, roughly corresponding to time zones. As it turned out, each orbital position will reach half the US—although the official government statement on the matter is that new technical advances make it feasible for each DBS bird to cover that large a territory. Under the new international agreement, Alaska, Hawaii, Puerto Rico, and the Virgin Islands will be served by spot beams from the US orbital positions.

One major setback for the US negotiating team at RARC was the adoption of a value of -107 dB (watts-per-square-meter) for power flux-density. The US had wanted a value of -105 dB. A high-power flux density is desired for the use of small, cheap receivers that are planned by most DBS operators. The higher power level may also be needed to offer the enhanced services such as high-definition television.

AUDIO BURSTS

Nippon Television Network has revealed preliminary findings from its test of audio-accompanied vertical-blanking-interval teletext. The NTV system sends music as coded digital signals—notes that can be compressed into 0.001 to 0.005 seconds. The ongoing NTV test has sent musical performances as long as one and a half minutes (2000 bytes transmitted in one second). Data received by the teletext decoder is stored and then played back using a microprocessor that controls the number of sound-source oscillators; those oscillators can generate the sound of six instruments or up to 11 voice parts. NTV expects the integrated audio device would be offered for barely \$25 above the price of non-audio teletext decoders—although commercial introduction is still several years away.

TELETEXT NEWS BITS

KSL-TV Channel 5 in Salt Lake City will become the second U.S. TV station to launch a commercial teletext service using World System Teletext format (based on the British format). Zenith will build teletext decoders, to be sold for about \$300 each to TV set owners in the Salt Lake City area.

Rockwell International has teamed up with Norpak, a leading Canadian teletext/videotex equipment maker. Jointly, the two companies want to accelerate an IC production schedule that could make it possible that NABTS/NAPLPS format decoders-receivers could be built for as little as \$500 by late 1984. The so-called "North American" standard has so far eluded efforts to build fairly low-cost hardware—and the involvement of Rockwell is seen as a positive sign to bring costs down.

R-E



performance by design

Folding Meters are Better

Not all multimeters fold. There's a reason. While other manufacturers were busy copying each others designs, BBC looked at where portable meters were used and how they could be improved.

The result is a unique approach. Folding meters with large displays (18 mm LCDs) and adjustable viewing angles. Now you can have high performance in a meter that excels in the field and on the bench.

Hands Free vs Handheld

In multimeters "hands free" is significantly better than "handheld." You need three hands to operate the typical "handheld" meter in the field. One for the meter and two for the probes. BBC's folding design lets you use a neck strap for the meter. This frees your hands for the probes.

On the bench, the large, adjustable displays pay off. It's a sensible design that lets you make measurements faster and more easily.



A Heritage of Precision

BBC's track record of expertise in precision engineering spans eight decades. All our meters are built to tough VDE and DIN safety standards. The 3 1/2-digit DMM's feature 0.1% basic dc accuracy and externally accessible fuses for overload protection.

Compact, Rugged and Affordable

To design the impact resistant case that protects these DMM's, BBC relied on the industrial design skills of the Porsche Design Studios.

When open, the display angle is easily adjustable. When closed, the display and the controls are protected, and the meters turn off automatically. Competitive pricing is another feature of BBC meters. Prices start at \$193.00.

Available Locally

BBC meters are available throughout the U.S. If your instrumentation supplier doesn't carry BBC yet, we'll gladly tell you who does. Call toll free:

1-800-821-6327
(In CO, 303-469-5231)

BBC - METRAWATT/GOERZ
6901 W. 117th Avenue
Broomfield, CO 80020, Telex 45-4540

Engineering Excellence in Test and Measurement



CIRCLE 60 ON FREE INFORMATION CARD

VIDEOGAMES

Staying power

DANNY GOODMAN

AS WE WERE THUMBING THROUGH OUR archive files on videogame software, we came upon a series of videogame-cartridge bestseller lists. For the most part those lists are based on telephone polls to dealers and distributors around the country to see each month which cartridges are doing best. Examining the results published in the first six months of 1983, it was interesting to see which games had the staying power to survive the whims of the cartridge-buying public.

The most noticeable fact is that it is the same cartridge producers who show up on the list month after month; Activision, Atari, Coleco, and Parker Brothers made the top ten every month. Next come those publishers who appear frequently—Imagic and Mattel. Beyond that, only CBS Games ever broke into the elite club for two months, each time with a different cartridge.

For that six-month period, Coleco was the winner with the highest number of mentions in the top ten: 17, including both *Colecovision* and 2600 titles. Activision and Atari were tied for second place with 14 each. The rest straggled in: Parker

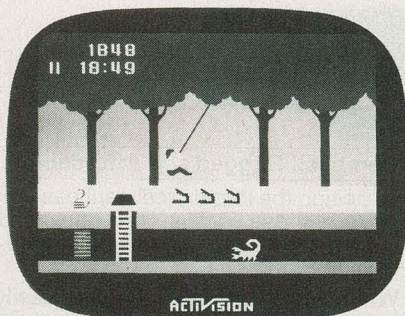


FIG. 1

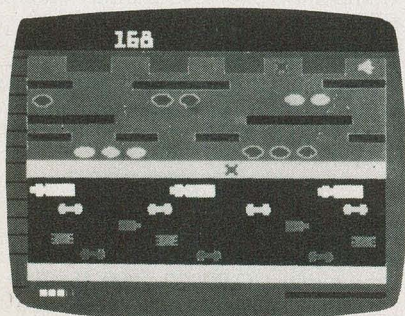


FIG. 2

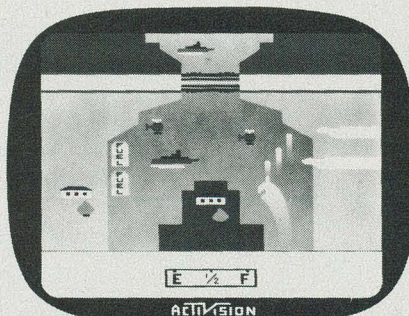


FIG. 3

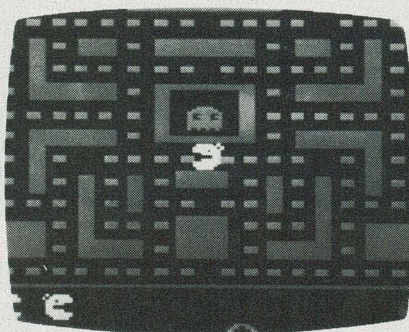


FIG. 4

Brothers with 6, Imagic with 4, Mattel with 3, and CBS with 2.

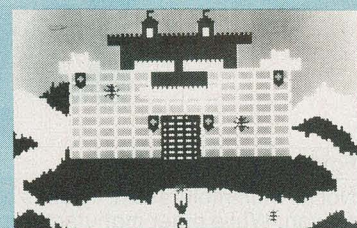
What is probably much more important, however, is that of the sixty possible top-ten slots over the period, very few titles managed to carry over for more than two months at a time. In fact, only five titles—*Pitfall*, *Frogger*, *River Raid*, *Ms. Pac-Man* (see Figs. 1-4), and *Donkey Kong* (for the 2600)—made the list for four or more months. It seems then, that cartridges with staying power are extremely rare, especially when you consider the hundreds of cartridges available today.

Much more typically, a good title will gather all kinds of support for a month or two after its introduction, and then disappear into the background. For example, the celebrated *E.T.* cartridge surfaced in the January list in 7th place. The following month it inched up to 6th. But by March it was gone. *Mouse Trap* for *Colecovision* zoomed instantly to 3rd place in February, only to never be seen on the list again. Even the Activision name doesn't guarantee a long-term winner. *Sea Quest* hit the charts in April in 8th place, but that was about it.

The strongest influence on whether a cartridge becomes a long-time hit or just a shot in the dark, we believe, is word of mouth. Few home videogame players are isolated from other players of the same console—in fact most games are bought because the buyer has played someone else's initially. That informal but powerful grapevine carries over to the purchase of cartridges later on. When a new cartridge hits the stores, a good number of "pioneers" venture out and buy it if the wording on the box looks intriguing. Thereafter, a good game's reputation will spread like wildfire. An outstanding game will keep that fire burning for many months as more and more players decide that they must have it.

Undeniably, those top-selling games are good-playing games. There is no secret formula. Interesting graphics, innovative sound, and novel and ever-challenging game play—those are the basics of cartridge staying power.

Imagic's *Ice Trek* for Intellivision



CIRCLE 101 ON FREE INFORMATION CARD

Imagic	Ice Trek									
GRAPHICS	1	2	3	4	5	6	7	8	9	10
SOUND	1	2	3	4	5	6	7	8	9	10
EASE OF LEARNING	1	2	3	4	5	6	7	8	9	10
CHALLENGE	1	2	3	4	5	6	7	8	9	10
VALUE	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good		Excellent			

There aren't many videogame cartridges that take on the guise of a Norse saga. One exception to that is *Ice Trek*
continued on page 14



FREQUENCY COUNTERS to 1.3 GHZ

By **OPTOelectronics inc.** Ft. Lauderdale, Florida

EST. 1974

MODEL K-7000-AC 10 Hz to 550 MHz counter. 50 Ohm & 1 Megohm inputs via BNC type connectors on rear panel. This model is available in optional kit form.

#K-7000-AC counter assembled 115VAC/12VDC \$150.
#K-7000-ACK counter kit form 120.
#Ni-Cad-70S internal Ni-Cad battery pack 25.

MODEL LFM:1110 Low frequency multiplier. A frequency counter accessory enabling tone frequencies to be counted faster and more accurately. Has low pass filter for off-the-air. Tone-squelch measurements. BNC input/output.

#LFM:1110 115VAC/12VDC \$150.

MODEL 7010-S 10 Hz to 600 MHz counter. 50 Ohm & 1 megohm inputs via BNC type connectors on rear panel. ± 1 PPM TCXO standard ± 0.1 PPM TCXO time base optional for greater accuracy. 10 mV average sensitivity. Very compact 6 1/2 digit counter: Size 2" H x 4" W x 5" D, 1 lb.

#7010-S 600 MHz counter 115 V AC/12 V DC \$235.
#TCXO-80 ± 0.1 PPM TCXO time base 75.
#Ni-Cad-76 Internal Ni-Cad Battery Pack 25.

MODELS 8007-S, 8010-S, 8013-S Deluxe series with frequency ranges of 10 Hz to 700 MHz, 1 GHz and 1.3 GHz. Standard features include: external clock input/output, excellent sensitivity, sealed ± 1 PPM 10 MHz TCXO time base, 4 gate times, 9 digit resolution to 175 MHz, front panel power jack for optional Broadband Preamp accessory, 115 V AC or 12 V DC operation, high quality compact construction housed in rugged aluminum cabinet. Optional features: internal Ni-Cad rechargeable battery operation, precision ± 0.1 PPM TCXO or ± 0.05 PPM proportional oven (OCXO) time base. All time base oscillators, including the standard TCXO, have 10 turn calibration adjustment accessible from rear panel. Size 3" H x 7 1/2" W x 6 1/2" D. 2 3/4 lbs.

#8007-S 700 MHz counter \$350.
#8010-S 1 GHz counter 425.
#8013-S 1.3 GHz counter 495.

OPTIONS:
#TCXO-80 ± 0.1 PPM TCXO time base 75.
#OCXO-80 ± 0.05 PPM (prop. oven) OCXO time base 125.
#Ni-Cad-86 Internal Ni-Cad battery pack 60.

MODEL AP-8015-A Broadband Preamp with 25 dB nominal gain from 1 MHz to 1 GHz, 10 dB gain at 1.3 GHz. Noise Figure less than 5.5 dB. supplied with AC adaptor or may be powered from power jack on 80XX-S series counters.

#AP-8015-A \$195.

#TA-100 Antenna, RF pick-up telescope style with right angle elbow and BNC connector. \$12.

- FULL YEAR GUARANTEE — ALL PRODUCTS.
- CERTIFIED NBS TRACEABLE CALIBRATION.
- ALL ALUMINUM CABINETS.

MOST ITEMS SHIPPED FROM STOCK
Prices/Specifications subject to change without notice or obligation.

MADE IN USA

AP-8015-A



MODEL	RANGE (FROM 10 Hz)	TIME BASE		AVERAGE SENSITIVITY		GATE TIMES	MAX RESOLUTION					SENSITIVITY CONTROL	EXT CLOCK INPUT/OUTPUT	METAL CASE	PROBE POWER JACK
		FREQ	STAB-DESIGN	BELOW 500 MHz	ABOVE 500 MHz		12 MHz	17 MHz	60 MHz	175 MHz	MAX FREQ				
K-7000-AC	550 MHz	5.24288	± 1 PPM-RTXO	15 mV -24 DBM	N/A	.1, 1 SEC	10 Hz		100 Hz			No	No	Yes	No
7010-S	600 MHz	10.0 MHz	± 1 PPM-TCXO ± 0.1 PPM-TCXO	10 mV -27 DBM	20 mV -21 DBM	.1, 1, 10 SEC	.1 Hz	1 Hz		10 Hz		Yes	No	Yes	No
8007-S	700 MHz	10.0 MHz	± 1 PPM-TCXO	10 mV -27 DBM	20 mV -21 DBM	.01, .1, 1, 10 SEC	.1 Hz	1 Hz	10 Hz		Yes	Yes	Yes	Yes	Yes
8010-S	1 GHz		± 0.1 PPM-TCXO												
8013-S	1.3 GHz		± 0.05 PPM-OCXO												

OPTOelectronics inc.
5821 NE 14 AVE. FT. LAUDERDALE FL 33334

VISA
MC
COD

TOLL FREE 800-327-5912
FLA 305-771-2050

To US and Canada Add 5% to max of \$10. per order for shipping/handling
Foreign orders add 15%

CIRCLE 62 ON FREE INFORMATION CARD

VIDEOGAMES

continued from page 12

from Imagic (981 University Avenue, Los Gatos, CA 95030), a modestly challenging and fun cartridge.

Ice Trek is a three-fold adventure of a character called "Vali" as he wends his way to the Ice Palace of Kalktron the Terrible. The first scene has Vali skiing across the tundra while dodging trees and stampeding caribou. If one of the antlers grabs Vali, he is dragged back to the edge of the screen and loses one life. If worse comes to worst, Vali has an axe with which he can slay one of the caribou, but doing so invokes the ire of the Wildlife Goddess, who shoots an arrow at him.

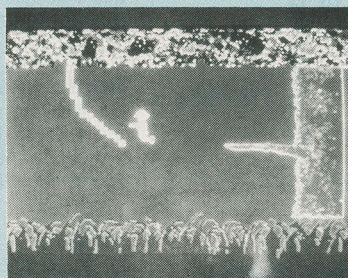
If he gets by the tundra, Vali winds up at the bank of a river loaded with floating icebergs. Using the controller buttons and aiming with the direction disk, you control Vali's hook as he tries to snare pieces of ice to build a bridge to the other side. Unfortunately, if an iceberg rams the existing bridge, Vali loses that part of the bridge, and probably ends up in the water, losing one life. To defend against that Vali has a torch with which he can melt oncoming icebergs. That game segment will be the most challenging for the beginner.

Finally, once Vali crosses the bridge, he is outside the Ice Palace. From below the palace, he must hurl torches up to several ice blocks and villains at the top, while they toss ice crystals down at Vali. If Vali is successful, the Ice Palace melts as a Wagner tune is played.

Perhaps we've been spoiled by Mattel's grandiose signalling an achievement such as that, complete with long musical renditions and sometimes special graphic displays. We were a bit disappointed, therefore, by the short and lifeless musical tribute to Vali's efforts the first time he melted the Ice Palace. Even in the rest of the game, the sound effects are not impressive; thundering caribou hooves and a flowing river signal the first two adventures. I do, however, like the sound and visual effects when an iceberg starts shaking the bridge before it breaks a piece of it off.

Atari's *Jungle Hunt* for Atari 2600

With the astounding success of Activision's *Pitfall*, it was only a matter of time before someone else devised a jungle-



CIRCLE 102 ON FREE INFORMATION CARD

Atari	Jungle Hunt									
GRAPHICS										
SOUND										
EASE OF LEARNING										
CHALLENGE										
VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good					Excellent

based adventure with a similar feel. And so we have *Jungle Hunt* from Atari (1265 Borregas Ave., Sunnyvale, CA 94086), a multiple-scene, horizontally scrolling game putting the human player in charge of an on-screen alter ego. Instead of guiding *Pitfall* Harry through an endless jungle of treasures, we guide Sir Dudley Dashly on his quest to rescue Lady Penelope from the jungle savages. Therein lies the main difference in how to approach the game, as we'll see.

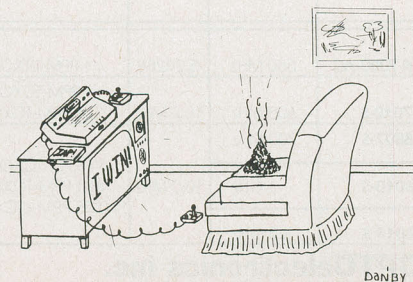
Jungle Hunt is chock full of different screen action, which helps to break up the monotony of a typical session. In the first part, Dudley must successfully swing along 11 erratically moving vines. Next he must swim through a river full of crocodiles (bonus points are available for knocking out as many crocodiles as possible, as long as his air supply holds out). Then comes a boulder field in which big and small boulders roll and bounce across the screen; Dudley must either duck or jump to avoid being hit by one. Finally, Dudley must jump over two spear-carrying guards. If he is successful, Dudley goes into the center of the village where he rescues Lady Penelope.

It's wonderful to see so many different scenes on a 2600 cartridge. Some clever designing went into coloring various background elements to make them appear to be completely different in succeeding scenes. However, it is a shame that most of the scenes appear flat, especially in comparison with David Crane's *Pitfall* from Activision.

In *Jungle Hunt* you are racing against a timer of sorts that counts down possible bonus points from the start of the round. What takes some of the excitement out of the game for us is that the adventure is finite—that is, it reaches a conclusion when you save Lady Penelope. With plenty of time left, you just restart the adventure. That doesn't seem logical to us. And once you've arrived at the scene to save Lady Penelope once, if you are like most players you lose a great deal of incentive to come back to the game again and try for a higher score.

The difference between *Pitfall* and *Jungle Hunt*, I suppose, is that in *Pitfall*, the score is the thing. You are in a constant race against the clock to try different routes to pick up more and more treasures along the way. But in *Jungle Hunt*, your attention is divided between saving Lady Penelope and the score. In your early attempts, the only thing you are going to care about is reaching Lady Penelope. Once you've done it, you've forgotten that there is even a score adding up to the top of the screen.

When you have gotten the feel of a game one way, it's awfully hard to shift gears and think about it in a new light, with new goals. If your cartridge budget limits you to one jungle-adventure game, then *Pitfall* may be a better choice. Just as in the movies, the remakes of classics are rarely as good as the originals. **R-E**



Danby

wabash diskettes

for
as
low
as

\$1.29 each!

Now get Wabash Quality at a CE Price

For over 17 years, Wabash has been making high quality and dependable computer products. Wabash diskettes are made to provide error-free performance on your computer system because every diskette has been totally and hypercritically tested. Since you can now buy Wabash computer products directly from CE, the world's largest distributor of magnetic media, you can now get maximum savings on every order. You can even order toll-free.

New Wabash Six Year Warranty

The quality of Wabash diskettes is stressed throughout the entire manufacturing process. After coating, all Wabash diskettes go through a unique burnishing process that gives each diskette a mirror-smooth appearance. Wabash then carefully applies a lubricant that is specially formulated to increase diskette life. Then, to keep out foreign particles, a unique heat seal bonds the jacket and liner together to help prevent contamination. After 100% hypercritical testing and certification, Wabash then packages each diskette, (except bulk pack) in a super strong and tear resistant Tyvek® envelope. The final Wabash product is then shrink-wrapped to insure cleanliness and reduce contamination during shipment. Wabash diskettes are so very reliable that Wabash now offers a six year warranty in case of defects in materials or workmanship on all diskettes purchased directly from Communications Electronics.

New...Wabash Diskette Duplication Services

Communications Electronics has teamed up with Wabash to provide a single-source solution for the diskette duplication requirements of software developers, OEM's and distributors. All service is in-house, to give you fast, dependable service. In most cases, delivery can be completed in five days. Whether you require 100, 1,000, or 10,000 copies per week, call CE first for a no obligation price quote. For additional information, please write us on your letterhead with your requirements.

SAVE ON WABASH DISKETTES

Product Description	Part #	CE quant. 100 price per disk (\$)
8" SSSD IBM Compatible (128 B/S, 26 Sectors)	F111	1.89
8" SSSD Shugart Compatible, 32 Hard Sector	F31A	1.89
8" SSDD IBM Compatible (128 B/S, 26 Sectors)	F131	2.39
8" DSDD Soft Sector (Unformatted)	F14A	2.99
8" DSDD Soft Sector (256 B/S, 26 Sectors)	F144	2.99
8" DSDD Soft Sector (512 B/S, 15 Sectors)	F145	2.99
8" DSDD Soft Sector (1024 B/S, 8 Sectors)	F147	2.99
5 1/4" SSSD Soft Sector w/Hub Ring	M11A	1.49
5 1/4" Same as above, but bulk pack w/o envelope	M11AB	1.29
5 1/4" SSSD 10 Hard Sector w/Hub Ring	M41A	1.49
5 1/4" SSSD 16 Hard Sector w/Hub Ring	M51A	1.49
5 1/4" SSDD Soft Sector w/Hub Ring	M13A	1.79
5 1/4" Same as above, but bulk pack w/o envelope	M13AB	1.59
5 1/4" SSDD 10 Hard Sector w/Hub Ring	M43A	1.79
5 1/4" SSDD 16 Hard Sector w/Hub Ring	M53A	1.79
5 1/4" DSDD Soft Sector w/Hub Ring	M14A	2.69
5 1/4" Same as above, but bulk pack w/o envelope	M14AB	2.49
5 1/4" DSDD 10 Hard Sector w/Hub Ring	M44A	2.69
5 1/4" DSDD 16 Hard Sector w/Hub Ring	M54A	2.69
5 1/4" SSQD Soft Sector w/Hub Ring (96 TPI)	M15A	2.59
5 1/4" DSQD Soft Sector w/Hub Ring (96 TPI)	M16A	3.69
5 1/4" Tyvek Diskette Envelopes - Price per 100 Pack	TE5	12.00

SSSD = Single Sided Single Density; SSDD = Single Sided Double Density;
DSDD = Double Sided Double Density; SSQD = Single Sided Quad Density;
DSQD = Double Sided Quad Density; TPI = Tracks per inch.

Quantity Discounts Available

Wabash diskettes are packed 10 disks to a carton and 10 cartons to a case. The economy bulk pack is packaged 100 disks to a case without envelopes or labels. Please order only in increments of 100 units for quantity 100 pricing. With the exception of bulk pack, we are also willing to accommodate your smaller orders. Quantities less than 100 units are available in increments of 10 units at a 20% surcharge above our 100 unit price. **Quantity discounts** are also available.

Order 500 or more disks at the same time and deduct 1%; 1,000 or more saves you 2%; 2,000 or more saves 3%; 5,000 or more saves 4%; 10,000 or more saves 5%; 25,000 or more saves 6%; 50,000 or more saves 7%; 100,000 or more saves 8%; 500,000 or more saves 9% and 1,000,000 or more disks earns you a 10% discount off our super low quantity 100 price. Almost all Wabash diskettes are immediately available from CE. Our efficient warehouse facilities are equipped to help us get you the quality product you need, when you need it. If you need further assistance to find the flexible disk that's right for you, call the Wabash compatibility hotline. Dial toll-free 800-323-9868 and ask for your compatibility representative. In Illinois or outside the U.S. dial 312-593-6363 between 9 AM to 4 PM Central time.

Buy Wabash Diskettes with Confidence

To get the fastest delivery from CE of your Wabash computer products, we recommend you phone your order directly to our Computer Products Division and charge it to your credit card. Be sure to calculate your price using the CE prices in this ad. Written purchase orders are accepted from approved government agencies and most well rated firms at a 30% surcharge for net 30 billing. For maximum savings, your order should be prepaid. All sales are subject to availability, acceptance and verification. All sales are final. All prices are in U.S. dollars. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Minimum *prepaid* order is \$50.00. Minimum *purchase order* \$200.00. All shipments are F.O.B. Ann Arbor, Michigan U.S.A. No COD's please. Non-certified and foreign checks require bank clearance.

For **shipping charges** add \$8.00 per case or partial case of 100 8-inch flexible disks or \$6.00 per case or partial case of 100 5 1/4-inch mini-diskettes for U.P.S. ground shipping and handling in the continental U.S.A.

Mail orders to: Communications Electronics, Box 1002, Ann Arbor, Michigan 48106 U.S.A. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-521-4414. In Canada, order toll-free by calling 800-265-4828. If you are outside the U.S. or in Michigan dial 313-994-4444. Telex anytime 810-223-2422. Order your Wabash diskettes today.

Copyright ©1983 Communications Electronics™

Ad #U12483



Order Toll-Free!
800-521-4414

In Michigan 313-994-4444

wabash
error-free
diskettes

**COMMUNICATIONS
ELECTRONICS™**

Computer Products Division

818 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.
Order TOLL-FREE 800-521-4414 or outside U.S.A. 313-994-4444

CIRCLE 81 ON FREE INFORMATION CARD

New from NRI...

Industrial Electronics with color computer.

**Get a head start in the emerging technologies
with practical training in control systems,
instrumentation, robotics, optoelectronics, and lasers.
Exclusive computer-aided instruction!**



Here's the training that gets you into the heart of American industry's rebirth. Over \$5 billion a year will be spent in automation alone...\$2.3 billion in computerized control systems...\$600 million in industrial robots and robotics is only just getting underway! To help meet the soaring demand for people to operate, maintain, repair, and design these control systems, NRI has created the only complete training in Industrial Electronics for Instrumentation and Control Technicians.

Learn on Your Own Computer

NRI training is more than lessons...it's experiences. You learn by doing, using the TRS-80™ color computer to learn about control systems, programming, and troubleshooting. It comes with special computer-aided instruction programs to speed learning, is expandable for business and personal computing, and is yours to keep. And that's just the beginning.

NRI's exclusive Discovery Lab® is designed to interface with your computer and special breadboarding card so you build demonstration circuitry, "see" inside your computer, and follow its operation. You also get profes-



Your training includes the TRS-80 color computer, the NRI Discovery Lab, interfacing breadboard, digital multimeter, frequency counter, computer-assisted training programs, audio instruction tape, and 46 profusely illustrated lessons.

sional quality instruments, including your own digital multimeter and CMOS frequency counter. You'll use them during your hands-on training, keep them to use in your work.

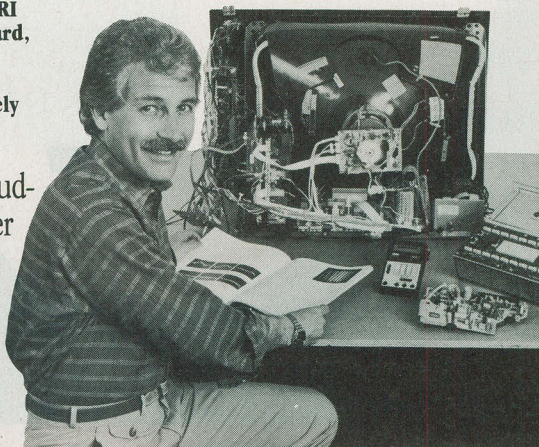
No Experience Needed

Your NRI training is thorough and complete. Starts you with the fundamentals, builds step-by-step up to the most advanced concepts. You learn about automatic control and feedback systems, control motors, numerical control systems, lasers and optoelectronics, robotics, microprocessors, instrumentation, computer peripherals, and much more. NRI keeps you up with technology to

make the most of the big demand for control and instrumentation technicians.

Send for Free Catalog

Send the postage-paid card for NRI's big electronic careers catalog. There's no cost or obligation, and no salesman will call. In it, you'll find complete lesson plans, equipment descriptions, and career opportunities in this exciting field. You'll also get information on almost a dozen other electronic courses including Microcomputers, Electronic Design, TV/Audio/Video Servicing, Digital Electronics, and more. Act today and get on with your future. If card has been used, write to us.



NRI Schools
McGraw-Hill Continuing
Education Center
3939 Wisconsin Ave.
Washington, D.C. 20016

We'll give you tomorrow.

(TRS-80 is a trademark of the Radio Shack division of Tandy Corp.)

TUNE IN THE SATELLITES

The DRAKE ESS2250 is a *complete* satellite TV reception system—*everything* you need to bring satellite TV into your home for the ultimate in selective TV viewing pleasure. At the heart of the system is a precision-contoured, ten-foot antenna which anyone can easily assemble "on-site", using simple hand tools. Mounted in the shroud at the focal point of the antenna is a sophisticated array of electronic gear capable of capturing weak satellite signals with impressive results. And the sturdy polar-mount is designed for easy manual or motorized rotation (optional) over the entire satellite arc.



You exercise complete control over the entire system with the DRAKE ESR224 earth station receiver which features the latest in solid-state microwave technology to provide superb performance and reliability. The functional design and contemporary styling of the receiver (along with a full line of accessories) will complement and ensure compatibility with any audio/video entertainment center for years to come. This system can be simply attached to any TV set and detailed instructions make it easy for the homeowner or local dealer to install everything with confidence. The entire package is easily shipped via U.P.S. to any continental U.S.A. location.

The DRAKE ESS2250 is pre-engineered to provide sharp, interference-free reception to most continental U.S. locations.

Write for our free color brochure and name of your local dealer. Your Drake dealer can provide a demonstration and complete technical information.



PIONEER MEMBER OF
SPACE

SIMULATED TV PICTURE

ESS2250 SYSTEM

FULL PERFORMANCE SATELLITE TV RECEPTION



R.L. Drake Company
540 Richard Street; Miamisburg, Ohio 45342
Phone: (513) 866-2421 Telex: 288-017

You can be confident when you buy DRAKE... the first name in satellite TV systems.
CIRCLE 28 ON FREE INFORMATION CARD

LETTERS

Address your comments to: Letters, Radio-Electronics,
200 Park Avenue South, New York, NY 10003

THE KAYPRO II

This is in reply to the review of the *Non-Linear Systems—Kaypro II* computer in the April 1983 *Radio-Electronics*. First, I have heard that the NLS unit was under development at the same time or before the Osborne unit, but underwent more revisions before actually coming to market than did the Osborne. Here are some relevant facts to the best of my knowledge.

The *Kaycomp I* was the initial prototype; it was never actually produced. That unit may have had one drive on each side of the screen. The next unit developed was that *Kaycomp II*, which had the fault of the "raster scan" or "cursor dance" that was noted in the review. Those first-production *Kaypro II*'s may have had the "cursor dance," but I haven't heard about it. That, I assume, was corrected early in 1982, before the actual production of the unit. Due to the name problem, the litera-

ture was revised and the name changed to *Kaypro II* when the hardware was improved.

Early keyboards—those I will call type "A"—did have a short travel and a hard-bottoming keystroke. Other units, type "B", have a different feel—the kind that your reviewer would prefer. If the CAPS LOCK lamp cover is slightly raised and has concentric circles, it is type A; the flush cross-hatch pattern lamp cover indicates a type-B keyboard. Both types A and B appear to be out in the field. My dealer has two A units on display, but mine has a B keyboard.

Early units *did* have the drives in vertical orientation; that was changed, and the brightness control went to the rear panel. It sounds as if the review unit may actually have been a *Kaycomp* or a very early *Kaypro II*. The chances are that most of the 10,000 finalized units shipped in 1982 contained none of the problems noted in the review, except the RFI.

My *Kaypro* is quite capable of blanking my RCA XL-100 on channels 2 and 4 when residing 36 inches from its antenna. A Japanese TV set of more recent vintage gets bad interference lines some 18 feet away. That problem is aggravated by connecting a printer cable, and mostly it radiates from the coiled keyboard cable.

I know that the literature has been updated more than once, as has the software. The original bundled software pak included the word processor from Select Information Systems, instead of the Perfect Writer/Speller/Filer/Calc. Old units also came with the ProfitPlan spreadsheet, the S-BASIC compiler, and the CP/M 2.2. Now new units come with the Perfect/ProfitPlan/S-BASIC and CP/M 2.2, as well as the Microsoft M-BASIC interpreter and a second spelling checker, as well as a Pac-Man and an adventure game.

My own S-BASIC compiler never did work-

QUALITY COMPONENTS - NOT MAIL ORDER "SECONDS"

Send SASE for FREE Flyer or send \$1.00 postage and handling for FREE COMPLETE CATALOG which includes coupon for \$1.00 OFF purchase.

ARIES ZERO INSERTION FORCE SOCKETS

cam actuated, true zero insertion—tin plated solder tail pins—capable of being plugged into dip sockets, including wire wrap.

Stock No.	No. Pins	1-9	10-49	50
11055	24	4.98	\$4.35	\$3.90
11056	28	5.15	4.50	4.05
11057	40	6.81	5.95	5.35
11058	64	12.02	10.50	9.45

IC-KOOLERS™ from UNITRACK™ dissipate over 2 watts of heat from IC's producing longer life and better performance. Just push IC-Kooler on—heat is collected from top and bottom of IC and dissipated. Won't shake loose!

Stock No.	No. Pins	Price
22225	14	\$.29
22226	16	.29
22228	18-20	.29

WILD ROVER

Touch switch capsule. Operating motion is .005" without the use of a levered arm. Extremely fast on and off with low noise. Normally open—rated 115 VAC, 1.6 amp-30 milliohm resistance—615 radius by .160 thick.

Stock No.	1-9	10 & Up
12098	\$1.42	\$1.28

MIC 6000Z

Single rotary switch operation. Large, easy to read 5 1/2 digit display, 800 hours operating life with single 5v battery. Seven functions—DC Volts, DC Amps, Ohms, AC Volts, AC Amps, Diode and Resistor Junction. Audible Continuity Check.

Stock No.	Price
82503	\$75.00

Full 1 year warranty.

DIGITAL MULTIMETER

Single rotary switch operation. Large, easy to read 5 1/2 digit display, 800 hours operating life with single 5v battery. Seven functions—DC Volts, DC Amps, Ohms, AC Volts, AC Amps, Diode and Resistor Junction. Audible Continuity Check.

Stock No.	Price
82504	\$10.00

Full 1 year warranty.

60/40 ROSIN CORE SOLDER

Stock No.	Dia	Length (feet)	Weight (oz)	Price
50075	.062	9	1.5	\$11.16
50076	.062	25	4	2.39
50077	.062	50	8	4.25
50078	.032	33	1.5	1.31
50079	.032	88	5	2.47
50080	.032	175	8	4.57

TI WIRE WRAP SOCKETS

Tin plated phosphor bronze contact—3 wrap

Stock No.	No. Pins	1-99	100-499	500
11301	8	\$.40	\$.36	\$.30
11302	14	.59	.54	.45
11303	16	.64	.58	.48
11304	18	.73	.66	.55
11305	20	.99	.90	.75
11306	22	1.12	1.02	.85
11307	24	1.25	1.14	.95
11308	28	1.52	1.38	1.15
11309	40	2.05	1.86	1.55

TI LOW PROFILE SOCKETS

Tin plated copper alloy 688 contact pins with gas tight seal.

Stock No.	No. Pins	1-24	25-99	999
11201	8	\$.10	\$.09	\$.08
11202	14	.14	.13	.12
11203	16	.16	.15	.14
11204	18	.18	.17	.15
11205	20	.20	.18	.16
11206	22	.22	.20	.18
11207	24	.24	.22	.20
11208	28	.28	.26	.25
11209	40	.40	.37	.33

EKI KITS come

with all parts necessary to assemble!
● Stock No. 88844 TV Jammer Kit "wipes out" your TV screen... \$ 7.71
● Stock No. 88850 Whooper Alarm Kit makes a great alarm or siren... \$11.33
MANY, MANY MORE KITS AVAILABLE IN FULL LINE CATALOG

ELPAC POWER SUPPLIES - DC/DC CONVERTERS

SINTEC Stock No.	ELPAC No.	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Dimensions (HxWxD) in Inches	Price
13825	CB3801	3-0-7.0	12±0.6	0-25	48x51x3.05	\$ 7.95
13826	CB3811	3-0-7.0	12±0.6	0-25	48x51x3.05	7.95
13827	CB3802	3-0-7.0	15±0.7	0-20	48x51x3.05	7.95
13828	CB3812	3-0-7.0	15±0.7	0-20	48x51x3.05	7.95
13829	CB3804	3-0-7.0	28±0.7	0-10	48x51x3.05	7.95
13830	CB3814	3-0-7.0	28±0.7	0-10	48x51x3.05	7.95
1.5 W TYPE:						
13831	CL3801	4-0-7.0	12±0.6	125	651x1.2x1.77	\$24.95
13832	CL3811	4-0-7.0	12±0.6	125	651x1.2x1.77	24.95
13833	CL3802	4-0-7.0	15±0.7	100	651x1.2x1.77	24.95
13834	CL3812	4-0-7.0	15±0.7	100	651x1.2x1.77	24.95
13835	CL3804	4-0-7.0	28±1.4	50	651x1.2x1.77	24.95
13836	CL3814	4-0-7.0	28±1.4	50	651x1.2x1.77	24.95
13825-1					DATA SHEET FOR DC/DC CONVERTERS	25

Special of the Month!

CONTACT ELECTRONICS D-SUBMINIATURE CONNECTORS (RS232)

Stock No.	Description	Price
11354	25 Male solder cup	\$1.65
11355	25 Female solder cup	2.45

OPCOA

Single Digit Displays - Common Cathode

Stock No.	Color	1	100
12082	Red	\$1.12	\$.99
12085	Green	1.84	1.63
12087	Yellow	1.92	1.70
12089	Orange	2.08	1.84

Right Angle Socket for Above Displays

Stock No.	1	100
11010	\$1.24	\$.99

The Battery Just Wrap™ Tool

New battery powered tool wraps insulated wire around .025" square posts without need for pre-cutting and pre-stripping. Complete with bit and 100 ft. 30 AWG wire.
Stock No. Description Price
13340 Battery just-wrap tool with bit and 100 ft. 30 AWG wire \$49.95
13341 Replacement bit 9.95
13342 100 ft blue replacement wire 6.95
13343 100 ft white replacement wire 6.95
13344 100 ft yellow replacement wire 6.95
13345 100 ft red replacement wire 6.95

MINI-DRILL

This portable hand drill is appropriate for circuit board drilling. Runs at 2500 RPM on 4 "AA" batteries (not included). Supplied with one .039 dia. drill bit. Drill stand is designed like a drill press for precise hole drilling.
Stock No. Description Price
13346 Hand drill with .039 dia. bit \$24.95
13347 Replacement bits, 2 each of .040 and .060 dia. 5.95
13348 Drill stand 13.95

PIN FORMING TOOL

puts IC's on their true row to row spacing. One side is for 300 centers. Flip tool over for devices on 600 centers. Put device in tool and squeeze.
NEW! ANTI-STATIC MODEL
ONE TOOL DOES 8 thru 40 PINS!
Stock No. 11059 \$12.95

OK MACHINE AND TOOL

IC INSERTION/EXTRACTION KIT
Includes: DIP IC extractor and inserter to use on commodore all IC's from 14 to 40 pins. Tools that engage conductive surfaces are CMOS safe and include ground ing tips.
Stock No. \$37.74
13309

SOCKET WRAP ID

DIP socket sized plastic panels with numbered holes in pin locations. Supports socket before wire wrapping. Identifies pins. Also write on them for location. IC part number function, etc. Simplifies initial wire wrapping, troubleshooting and repair.
\$1.82 per pack

IC EXTRACTOR

One-piece, spring steel construction. Will extract all LSI, MSI and SSL devices with 8 to 24 pins.
Stock No. 13313 \$2.10

OPTEL LCD's with pins

±1.8:8.8 Stock No. 47005

8.8:8.8 Stock No. 47006

8.8:8.8 Stock No. 47007

Stock No.	Description	1	10
47005	3 1/2 dig. 5"	\$ 5.95	\$ 5.50
47006	4 dig. 5"	5.95	5.50
47007	4 dig. 7"	11.90	11.00

SINTEC

28 8th Ave., Box 410
co. Frenchtown, NJ 08825



TOLL 800-526-5960
FREE in NJ (201) 996-4093

We accept VISA, MC, C.O.D., CHECK, or M.O.
INCLUDE SHIPPING CHARGES—
0 to \$100—\$3.00
\$100 to \$250—\$4.00
over \$250—\$5.00

—even on the supplied demonstration programs. The irony of that is that Non-Linear Systems now wants an extra \$75.00 from previous Kaypro owners for the M-BASIC, The Word Speller & Games pak that is now the "standard" bundled software. While that price certainly beats paying about \$400.00 to get those things elsewhere, it displays a shameless corporate lack of tact by NLS and Kaypro toward previous Kaypro II owners.

All in all, however (lack of tact aside), I would say that the NLS/Kaypro deserves a "9" in the price/value category, even if the eight book-sized manuals are a lot of reading and somewhat difficult.

STEVEN L. BENDER
Queens Village, NY

DRY TRANSFERS

I was interested to see the article about dry transfers as a resist medium in the **Radio-Electronics Annual, 1983**, though of course it alluded to other brands than the one that CERES distributes here in Canada.

However, I think that your readers might be justifiably puzzled when they come upon the statement in another story in the same issue wherein dry transfers are referred to somewhat negatively, saying in particular that they are prone to wash off in the etchant.

To put the matter straight: Wash-off is simply not encountered with this medium. Our product is unconditionally guaranteed in that, as well as in other, respects; and in five years, only four sheets of transfers have ever been returned—and the reason for return was *not* "wash-off." Etching temperatures almost to the boiling point are withstood and results are exceptionally crisp and clean, thanks to the

excellent adhesion and thinness of the transfer medium.

I am surprised to learn that the brands available in the US do not provide curves or corners; our line includes quite a variety of them, with various degrees of curvature and of different thickness. As we advise our customers, layout tapes *do* work, but their performance on curves is inferior to that of transfers.

One final comment: Again, I do not know whether this applies to brands sold in the US, but one of our strongest selling points is dry transfers' capability to accomplish very fine work and permit high component density. Our line allows leads to be routed between the pads of IC DIP sockets—which is very difficult to do with any other "home" medium.

JOHN COX
CERES,
866 Bloor Street West
Toronto, ONT M6G 1M5

UHF TV PREAMPLIFIER

I just finished building the UHF TV Preamplifier that was presented in the March and May 1982 issues of **Radio-Electronics**, and am very pleased with the results.

There is still an error in the parts-placement diagram that was reprinted in the May 1982 issue. The amplifier failed to work properly at first, so I compared my unit against the schematic diagram. I also noticed that the voltages on the transistors did not appear to be correct. I then found that four resistors were switched on the parts-placement diagram. Resistors R1 and R2 should be interchanged, and resistors R3 and R4 should be interchanged. That will considerably raise

the voltage on transistors Q1 and Q2.

I ordered the chip capacitors by mail from MHz Electronics in Phoenix, AZ, and received them by mail in only seven days. I substituted MRF901 transistors which I got from Radio Shack (#276-2044) and found them to work very well.

After I had the amplifier assembled and working, I had one of the engineers where I work check the gain across most of the UHF band. My lowest gain was 30 dB.

I am using the amplifier at the antenna, which is the Simple Simon Electronics model STVA-4, and am very pleased with the results. I use the antenna system mostly to pull in some distant UHF stations.

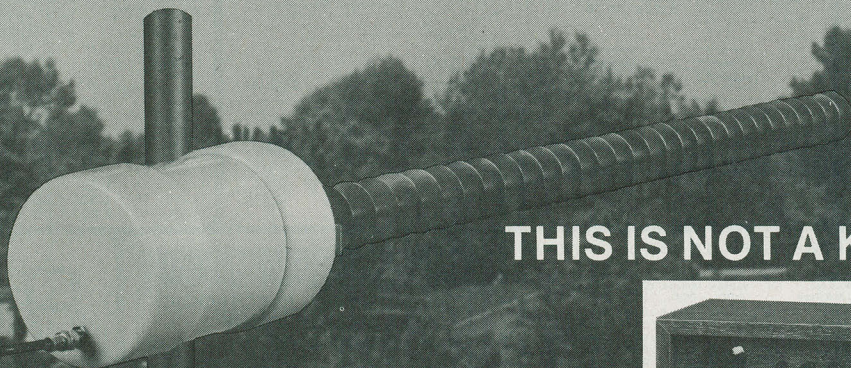
Please keep the excellent articles coming. I am a Senior Technical Writer for The Heath Company, and have enjoyed reading your magazine for many years.

RANDY KAEDING, K8TMK
Stevensville, MI

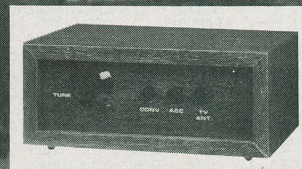
REWINDING TRANSFORMERS

The article, "Rewinding Transformers", in your May 1983 issue caught my eye for two reasons. First, I had problems dismantling a large choke for a magnet project. Large power transformers or chokes are sometimes not only enameled but are also covered with globs of black, tarry material. After much sawing and prying at the laminations unsuccessfully, I was about to give up. My father informed me that the best way to deal with the problem was to burn the choke in a good fire. The next day, when the charcoal grill had cooled, I removed the choke and took the bolts from the laminations. It practically fell

VARIABLE MICROWAVE DOWN CONVERTER



THIS IS NOT A KIT!!



QUANTITY DISCOUNT

1.....	79.95
10.....	74.95
25.....	69.95
50.....	64.95
100.....	59.95

All down converters built
with New HOT Transistor
for more amplifier gain.
GREATER DISTANCE

NEW—Power supply built
with push button simplicity
ABC Switch built in

★ Coax cable not included

PLEASE ADD
SUFFICIENT
POSTAGE

1 Unit weighs 5 lbs.

To order by Visa or Master Charge
No C.O.D. orders

Call 800-428-3500
Information 317-291-7262
6254 La Pas Trail
Indianapolis, Indiana 46268

**ELECTRONIC
RAINBOW INC**

COMMODORE 64

(more power than Apple II at half the price)

\$99.50*

- 170K DISK DRIVE \$159.00*
- TRACTION FRICTION PRINTER \$119.00*

(* with software savings applied)

COMMODORE 64 COMPUTER \$99.50

You pay only \$199.50 when you order the powerful 84K COMMODORE 65 COMPUTER! LESS the value of the SPECIAL SOFTWARE COUPON we pack with your computer that allows you to SAVE OVER \$100 off software sale prices!! With only \$100 of savings applied, your net computer cost is \$99.50!!

SOFTWARE BONUS PACK \$29.95

When you buy the Commodore 64 Computer from Protecto Enterprises you qualify to purchase ONE SOFTWARE BONUS PACK for a special price of \$29.95!! Normal price is \$49.95 (40 programs on disk or 24 programs on 5 tapes).

170 DISK DRIVE \$159.00

You pay only \$259.00 when you order the 170K Disk Drive! LESS the value of the SPECIAL SOFTWARE COUPON we pack with your disk drive that allows you to SAVE OVER \$100 off software sale prices!! With only \$100 of savings applied, your net disk drive cost is \$159.00.

TRACTION FRICTION PRINTER \$119.00

You pay only \$219.00 when you order the Comstar T/F deluxe line printer that prints 8 1/2 x 11 full size, single sheet, roll or fan fold paper, labels etc. 40, 66, 80, 132 columns. Impact dot matrix, bi-directional, 80 CPS. LESS the value of the SPECIAL SOFTWARE COUPON we pack with your printer that allows you to SAVE OVER \$100 off software sale prices!! With only \$100 of savings applied your net printer cost is only \$119.00.

80 COLUMN BOARD \$149.00

You pay only \$149.00 for this 80 Column Board. Included with this board is word processor pack, electronic spread sheet and mail merge data base on two tapes. List \$249.00. (Disk add \$10.00).

80 COLUMN

WORD PROCESSING PACKAGE \$79.00

SCRIPT 64 EXECUTIVE WORD PROCESSOR is the finest available for the COMMODORE 64 Computer! THE ULTIMATE for PROFESSIONAL wordprocessing application. DISPLAYS 80 COLUMNS IN COLOR. Featuring simple operation, powerful text editing with a customized 250 word dictionary, complete cursor and insert/delete key controls, line and paragraph insertion, automatic deletion, centering, margin settings and output to all printers. Included is a powerful MAIL MERGE When used with THE COMPLETE DATA BASE PACKAGE. List \$99.00. Sale \$79.00. Coupon Price \$52.00. (Disk only).

COMPUTER AND SOFTWARE CHRISTMAS SALE

WE
HAVE
THE
BEST
SERVICE

WE
HAVE
THE
LOWEST
PRICES

SPECIAL SOFTWARE COUPON

We pack a SPECIAL SOFTWARE COUPON with every COMMODORE 64 COMPUTER-DISK DRIVE-PRINTER-MONITOR we sell! This coupon allows you to SAVE OVER \$100 OFF SALE PRICES! \$200-\$300 savings are possible!! (example)

PROFESSIONAL SOFTWARE COMMODORE 64

Name	List	Coupon
Executive Word Processor	\$99.00	\$52.00
Complete Data Base	\$89.00	\$46.00
Electronic Spreadsheet	\$89.00	\$46.00
Accounting Pack	\$69.00	\$32.00
Total 5.2 Word Processor—Plus		
Tape	\$69.00	\$37.00
Disk	\$79.95	\$42.00
Total Text 2.6 Word Processor—		
Tape	\$44.95	\$26.00
Disk	\$49.95	\$26.00
Total Label 2.6	\$24.95	\$12.00
Disk	\$29.95	\$15.00
Quick Brown Fox Word		
Processor	\$69.00	\$40.00
Programmers Reference		
Guide	\$20.05	\$12.50
Programmers Helper	\$69.00	\$40.00
Basic Tutor	\$29.95	\$15.00
Typing Teacher	\$29.95	\$15.00
Sprite Designer	\$16.95	\$10.00
Medicinemem	\$19.95	\$12.00
Weather War II	\$19.95	\$12.00
Music-Maker	\$19.95	\$12.00
EDU-Pack	\$24.95	\$13.00
3D Maze Craze	\$24.95	\$13.00
Professional Joy Stick	\$24.95	\$12.00
Light Pen	\$39.95	\$20.00
Deluxe Dust Cover	\$ 8.95	\$ 4.60

(and many other items)

Write or call for

Sample SPECIAL SOFTWARE COUPON!

PROFESSIONAL BUSINESS SOFTWARE EXECUTIVE QUALITY BY TIME WORKS!

The Cadillac of business programs for Commodore 64 Computers

Item	List	*SALE
Inventory Management	\$89.00	\$69.00
Accounts Receivable	\$89.00	\$69.00
Accounts Payable	\$89.00	\$69.00
Payroll Management	\$89.00	\$69.00
Cash Flow Management	\$89.00	\$69.00
Sales Analysis	\$89.00	\$69.00
General Ledger	\$89.00	\$69.00

(*COUPON PRICE \$59.00)

VIC-20

(a real computer at the price of a toy)

\$77.00*

- 40-80 COLUMN BOARD \$89.00
- VOICE SYNTHESIZER \$59.00

(* with Cassette and Gortek purchase)

VIC-20 COMPUTER \$77.00

You get the Commodore VIC-20 Computer for only \$77.00 when you buy at sale prices: The Commodore Data Cassette for only \$69.00 and the Gortek Introduction to Basic program for only \$19.95. TOTAL LIST PRICE \$302.95. SPECIAL PACKAGE SALE PRICE \$165.25.

40-80 COLUMN BOARD \$89.00

A fantastic price breakthrough for VIC-20 owners on this most wanted accessory!! "Now you can get 40 or 80 Columns on your T.V. or Monitor Screen." Plus we add a word processor with mail merge, electronic spread sheet, time manager and terminal emulator!! These PLUS programs require 8K or 16K RAM memory. (Disk add \$10.00).

VOICE SYNTHESIZER \$59.00

Votrax Based. Make your VIC-20 COMPUTER TALK! Has features equivalent to other models costing over \$370.00. You can program an unlimited number of words and sentences and even adjust volume and pitch. You can make adventure games that talk! A must for enhancing your programming creativity and pleasure.

60K MEMORY EXPANDER \$59.00

Sixslot — Switch selectable — Reset button — Ribbon cable. A must to get the most out of your VIC-20 Computer. Includes FREE \$29.95 adventure game.

8K RAM CARTRIDGE \$39.95

Increases programming power 2 1/2 times. Expands total memory to 33K (33,000 bytes). Memory block switches are on outside of cover! Includes FREE \$16.95 game.

16K RAM CARTRIDGE \$69.00

Increases programming power 4 times. Expands total memory to 41K (41,000 bytes). Memory block switches are an outside cover! Includes FREE \$29.95 adventure game!!

12" GREEN SCREEN MONITOR \$99.00

Excellent quality GREEN PHOSPHOROUS VIDEO MONITOR with antiglare, 1920 characters (80 characters x 24 rows). Save your TV! A must for 80 column word processors. PLUS \$9.95 for VIC 20 or Commodore 64 Cable.

12" AMBER SCREEN MONITOR \$119.00

Premium quality AMBER VIDEO MONITOR with antiglare, (80 characters x 24 rows), exceptionally clear screen, faster scanning, 1000 lines. PLUS \$9.95 for VIC 20 or Commodore 64 Cable.

- LOWEST PRICES • 15 DAY FREE TRIAL • 90 DAY FREE REPLACEMENT WARRANTY
- BEST SERVICE IN U.S.A. • ONE DAY EXPRESS MAIL • OVER 500 PROGRAMS • FREE CATALOGS

Add \$10.00 for shipping, handling and insurance. Illinois residents please add 6% tax. Add \$20.00 for CANADA, PUERTO RICO, HAWAII orders. WE DO NOT EXPORT TO OTHER COUNTRIES.
Enclose Cashiers Check, Money Order or Personal Check. Allow 14 days for delivery, 2 to 7 days for phone orders. 1 day express mail! Canada orders must be in U.S. dollars. VISA — MASTER CARD — C.O.D.

CIRCLE 24 ON FREE INFORMATION CARD

PROTECTO ENTERPRISES

(WE LOVE OUR CUSTOMERS)

BOX 550, BARRINGTON, ILLINOIS 60010
Phone 312/382-5244 to order

apart in my hands.

The second reason I appreciated the article was because of the uses to which I'd put my laminations. All "E"-shaped laminations were varnished back together, and all "I" sections likewise. Mount the "E" on its back and wind 300 turns of #18 AWG Belden enameled magnet wire around the center pole. Using that "E-I" magnet, and a few common electrical parts, you can demonstrate transformer action, a saturable reactor, resistance soldering, an electromagnet (about 1600 Gauss at center pole), AC synchronous motor, and a cute levitation trick (Lenz's law).

All those projects and more can be found in a book called *Projects in Basic Magnetism*, by John P. Shields, published by Howard W. Sams & Co., 1965. I strongly recommend it to anyone interested in applications of a ver-

satile fundamental component in electronics. It might even make a good series for your magazine.

JOE CARR
Ft. Worth, TX

SPEED-LIMIT LAWS

In the "Letters" department, **Radio-Electronics**, March 1983 issue, Mr. Kolasinski's conclusion is that because many or most drivers exceed a given speed limit, "... it is the intent of most drivers to break the speed-limit laws."

It just might be that those speeding drivers realize that life is very short, and that time spent while driving from point A to point B is wasted time. So, in speeding, they are trying to use their lives productively and efficiently by minimizing wasted time.

Highway speed limits have little to do with fuel conservation, safety, or saving lives. They are strictly a means of allowing cops who are incapable of dealing with real criminals (murderers, robbers, rapists, drug pushers, etc.) to issue their quota of tickets easily and thus earn their keep. Any fuel savings due to the 55-mph limit vs. a 70-mph limit is too small to measure relative to the country's overall use of crude oil. If safety were a concern, the laws would allow whatever speeds are reasonable for existing conditions. Where is the sense in being allowed to drive 55 mph on a main highway in heavy, rush-hour traffic with cars very close to each other, yet being ticketed for doing 30 mph in a 25-mph zone at 2 AM when there is not a pedestrian or any other car in sight?

Yes, both in 1974 (when the 55-mph limit took effect) and 1975, about 9,300 fewer people died due to traffic accidents than those who died of the same cause in 1973. But that is largely because drivers had the skills to drive at 70 mph, so in driving at 55 mph they were overskilled, and accident rates dropped. But as the skills were lost, because of disuse the death rates have climbed to near their 1973 figures.

One should keep the number of auto deaths in perspective. In 1980, 52,411 people died in accidents related to motor vehicles. But that is only 2.72% of the total of 1,927,788 persons dying in the United States from all causes (National Safety Council figures). So while cutting auto-related deaths by 10,000 sounds impressive, it means only a 0.52% drop in overall number of U.S. deaths.

RAYMOND KOSTANTY
Wood-Ridge, NJ

HOLOGRAPHIC DISPLAYS

Having just received the June 1983 issue of **Radio-Electronics**, the first thing I did was to read the regular columns, and on reading the editorial (videogames, etc.), I was amazed to find reference to holographic displays. The reason why I was amazed is that I have made arrangements with TI on just such an item. Without going in to construction details, I will state that it is closer than you think, and is compatible with normal color-TV signals, as well as monochromatic material. The display is, of course, solid state, and requires comparatively little power. It is conceivable to get reductions in the power-consumption figures as the learning curve is progressed.

Good thinking on your part even to consider such a device as a possibility.

It is also to be noted that there is a chance of production agreements on the following items also: a method of receiving wide-band signals at zero bandwidth (compatible), and a method of transmitting and receiving wide-band signals at zero bandwidth, T.E. DEAGLE, Inventor
State Farm, VA

COMMENDATIONS

I wish to commend authors Marc Stern and Herb Friedman on their well-written, very informative articles on computers, hardware, and software in the April 1983 **Radio-Electronics**. That is must reading for anyone wishing to replace his ignorance about this explosive field, and especially so for the first-time computer buyer. I give your special section four stars.

R-E
WELLINGTON LEE
Chicago, IL

SPECIALS

REPLACEMENT FOR
ADC QLM30MKIII
MAGNETIC
CARTRIDGE
PART NO.
CE-487



\$4.95

THESE ITEMS ARE FOR 10 OR MORE

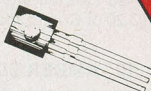
SORRY, NO MIXED QUANTITIES

*** FREE SHIPPING
& HANDLING**

IF ORDER IS 5 LBS. OR LESS
GOOD ONLY IN THE
CONTINENTAL U.S.
WITH PURCHASE
ORDER OF \$75
OR MORE

*** FREE T-SHIRT**
WITH ORDER OF \$75 OR MORE

CEI-123AP
TRANSISTOR



9¢

2SC 1172B
HORIZONTAL OUTPUT
TRANSISTOR
SIMILAR TO
ECG® 238



\$1.95



Consolidated Electronics Incorporated

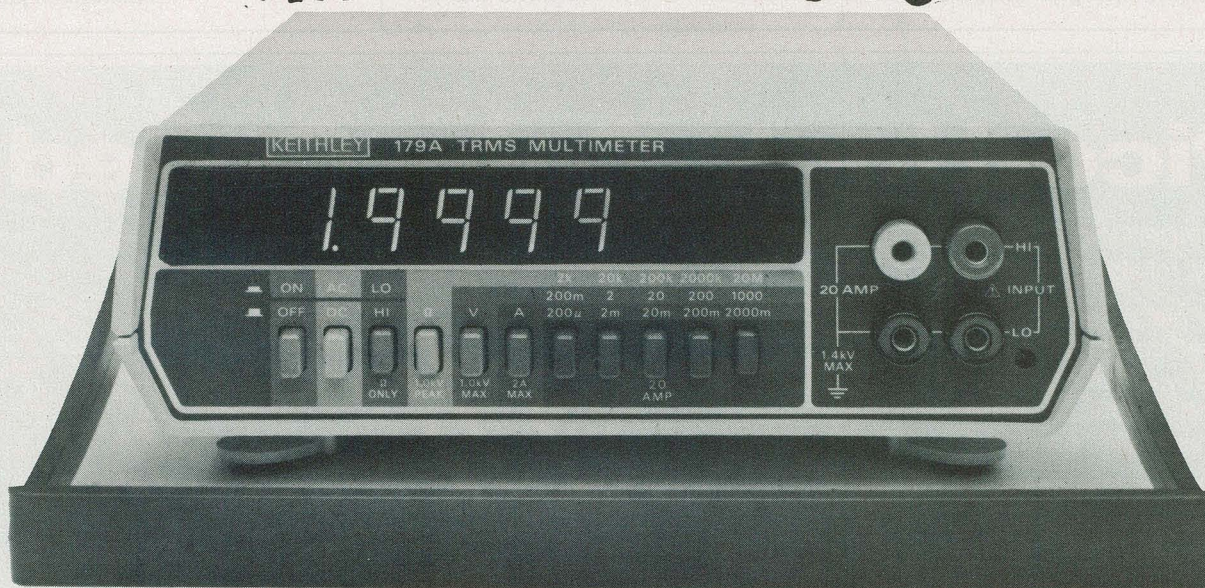
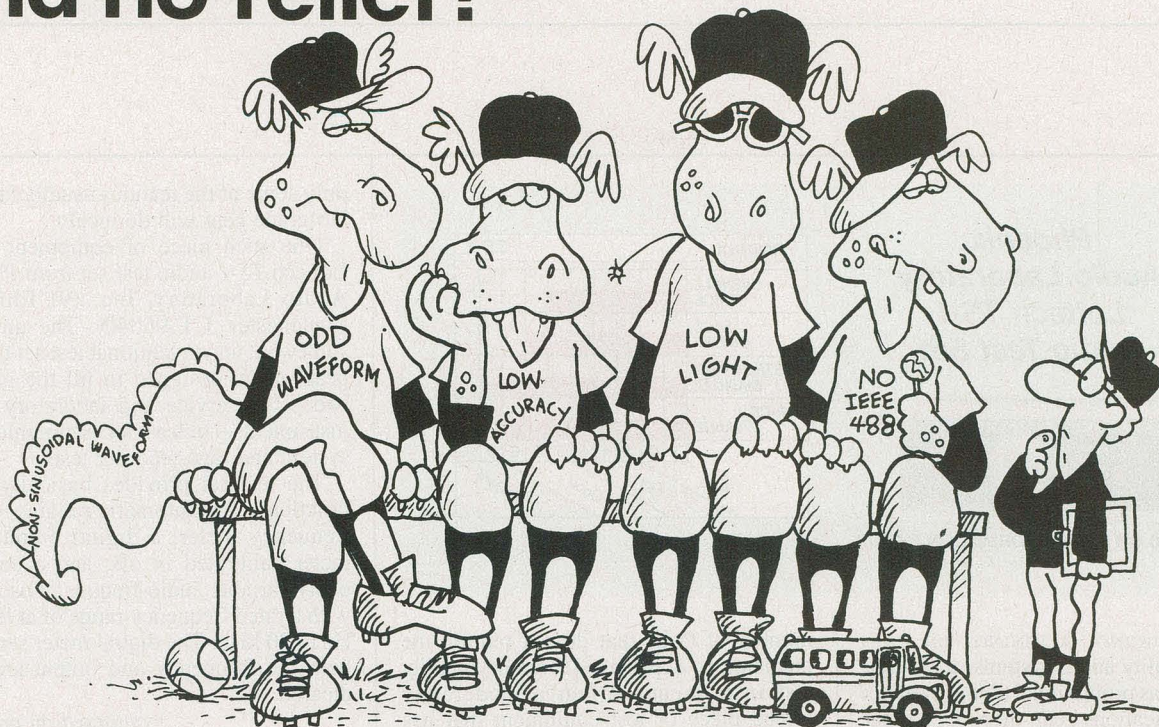
705 WATERLIET AVE., DAYTON, OHIO 45420 IN DAYTON, (513) 252-5662

1-800-543-3568
NATIONAL WATS

**CALL TOLL
FREE TODAY!**

1-800-762-3412
OHIO WATS

A bench full of dragons and no relief?



Send in old reliable Keithley 179A. It could help you save the game. Get the high-performance accuracy you need today, and field-installable IEEE-488 compatibility you'll need soon. Our oversize LED is easier to read. And non-sinusoidal waveforms won't throw you a curve with our TRMS. Here's your workhorse Portable/Bench DMM at a price that won't strike out your budget. Keithley DMMs and Thermometers. **The Dragon Slayers.**

KEITHLEY

179A Features

- Five full functions
- 10 μ V sensitivity
- 20A capability
- 0.04% DCV accuracy
- HI-LO Ω
- Field-installable battery pack
- Field-installable IEEE-488 Interface
- \$379

Price U.S.A. only.

Write Tom Hayden for your free, frameable 9 x 12" dragon poster. Keithley Instruments, Inc., 28775 Aurora Road, Cleveland, Ohio 44139.
Phone 216-248-0400. Telex: 98-5469.

CIRCLE 36 ON FREE INFORMATION CARD

EQUIPMENT REPORTS

Phoenix Audio Laboratory Loftech TS-1 Audio Test Set



CIRCLE 103 ON FREE INFORMATION CARD

Phoenix					TS-1				
OVERALL PRICE									
EASE OF USE									
INSTRUCTION MANUAL									
PRICE/VALUE									
	1	2	3	4	5	6	7	8	9 10
	Poor		Fair		Good		Excellent		

WHEN SERVICING, ALIGNING, OR CALIBRATING quality audio systems, including such things as professional taping systems or communications gear, there are a great

number of tasks that do not require the precision of expensive laboratory-quality test instruments. Often a moderately priced piece of test equipment that has

only some of the features usually found in lab-grade gear will do nicely

One such piece of equipment is the Loftech TS-1 audio test set from Phoenix Audio Laboratory, Inc. (91 Elm ST., Manchester, CT 06040). The unit is a somewhat unconventional test set that appears to be designed to fill the gap between the service and laboratory grade instruments—at least for communication-system and tape-recorder tests.

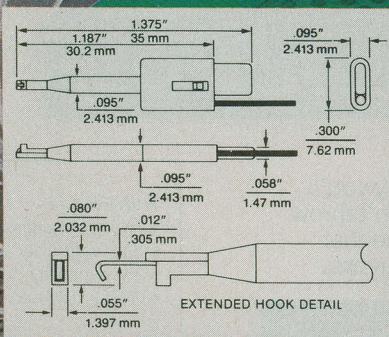
The test set provides basically three functions: An automatic-ranging digital frequency meter; a digital output-level meter calibrated in dB, and a continuously variable audio-frequency oscillator with a rated frequency range of at least 15 Hz to 30 kHz. The digital meter serves as both the frequency and output-level indicator.

continued on page 32

Pico-Hook. Color Coded.

E-Z PICO HOOK. Small and narrow for easy, reliable test contact.

One piece Beryllium Copper Gold Plated conductor assures signal accuracy. Color coded in up to 1,000 combinations. Available with leads or assembled on your cable.



E-Z-HOOK®

E-Z HOOK, A DIVISION OF TEKTEST, INC.,

225 North Second Ave., Arcadia, CA 91006, P.O. Box 450, (213) 446-6175 TWX 910-582-1614



ACTUAL SIZE

CIRCLE 78 ON FREE INFORMATION CARD

"I built this 16-bit computer and saved money. Learned a lot, too."

Save now by building the Heathkit H-100 yourself. Save later because your computer investment won't become obsolete for many years to come.

Save by building it yourself. You can save hundreds of dollars over assembled prices when you choose the new H-100 16-Bit/8-Bit Computer Kit – money you can use to buy the peripherals and software of your choice.

H-100 SERIES COMPUTER SPECIFICATIONS:

USER MEMORY:
192K-768K bytes*

MICROPROCESSORS:
16-bit: 8088
8-bit: 8085

DISK STORAGE:
5.25" disk drive,
8" disk drive
Winchester drive

KEYBOARD:
Typewriter style, 95 keys,
13 function keys,
18-key numeric pad

GRAPHICS:
Always in graphics mode.
640h/225v resolution; up to
eight colors are available**

COMMUNICATIONS:
Two RS-232C Serial
Interface Ports and
one parallel port

DIAGNOSTICS:
Memory self-test
on power-up

AVAILABLE SOFTWARE:
Z-DOS (MS-DOS)
CP/M®
Z-BASIC Language
Microsoft BASIC
Multiplan
SuperCalc
WordStar

MailMerge
Data Base Manager
File Manager
General Ledger
Accounts Receivable
Accounts Payable
Inventory Control
Sales Invoicing
Lotus 1,2,3
PeachText 5000
Fortran-86
Cobol-86
Pascal
Basic Compiler
Most standard
8-bit CP/M
Software

The H-100 is easy to build – the step-by-step Heathkit manual shows you how. And every step of the way, you have our pledge – "We won't let you fail." Help is as close as your phone, or the nearest Heathkit Electronic Center.†

And what better way to learn state-of-the-art computing techniques than to build the world's only 16-bit/8-bit computer kit? To run today's higher-speed, higher-performance 16-bit software, you need an H-100. It makes a big difference by processing more data faster.

Dual microprocessors for power and compatibility. The H-100 handles both high-performance 16-bit software and most current Heath/Zenith 8-bit software.

Want room to grow? The H-100's standard 192K byte Random Access Memory complement can be expanded to 768K bytes – compared to a 64K standard for many desktop computers.

And the industry-standard S-100 card slots support memory expansion and additional peripheral devices, allowing your investment to grow.

High-capacity disk storage, too. The H-100's 5.25" floppy disk drive can store 320K bytes on a single disk. The computer also supports an optional second 5.25" and external 8" floppy disk drives. For maximum storage, an optional internal Winchester disk drive is also available.

For more information, circle the reader service number below. Better yet, visit your Heathkit Electronic Center for a demonstration!

*The H-100 gives me
the most for my
computer dollar!*

*192K bytes standard.

**Optional.
CP/M is a registered
trademark of Digital
Research.



Heathkit®
Heath
Company

A subsidiary of Zenith Radio Corporation

†Heathkit Electronic Centers are units of Veritechnology Electronics Corporation.

CIRCLE 37 ON FREE INFORMATION CARD

HITACHI



Non-Linear Systems

KEITHLEY



FLUKE

VIZ NSA

DATA PRECISION

BK PRECISION

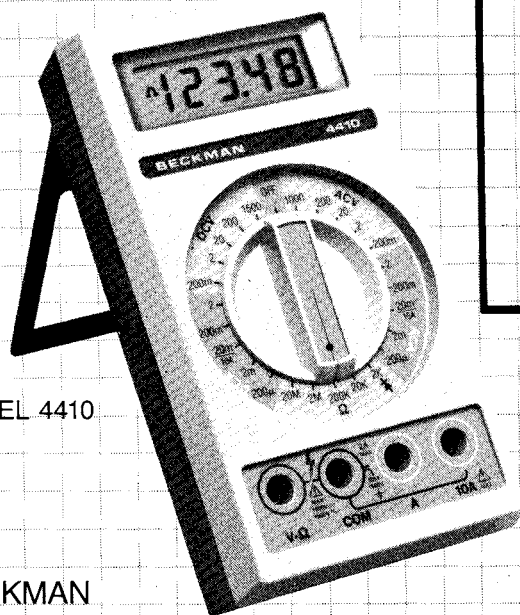
LEADER



HITACHI

OSCILLOSCOPES

...Quality and
Performance
Beckman and
4½ Digits...
True RMS



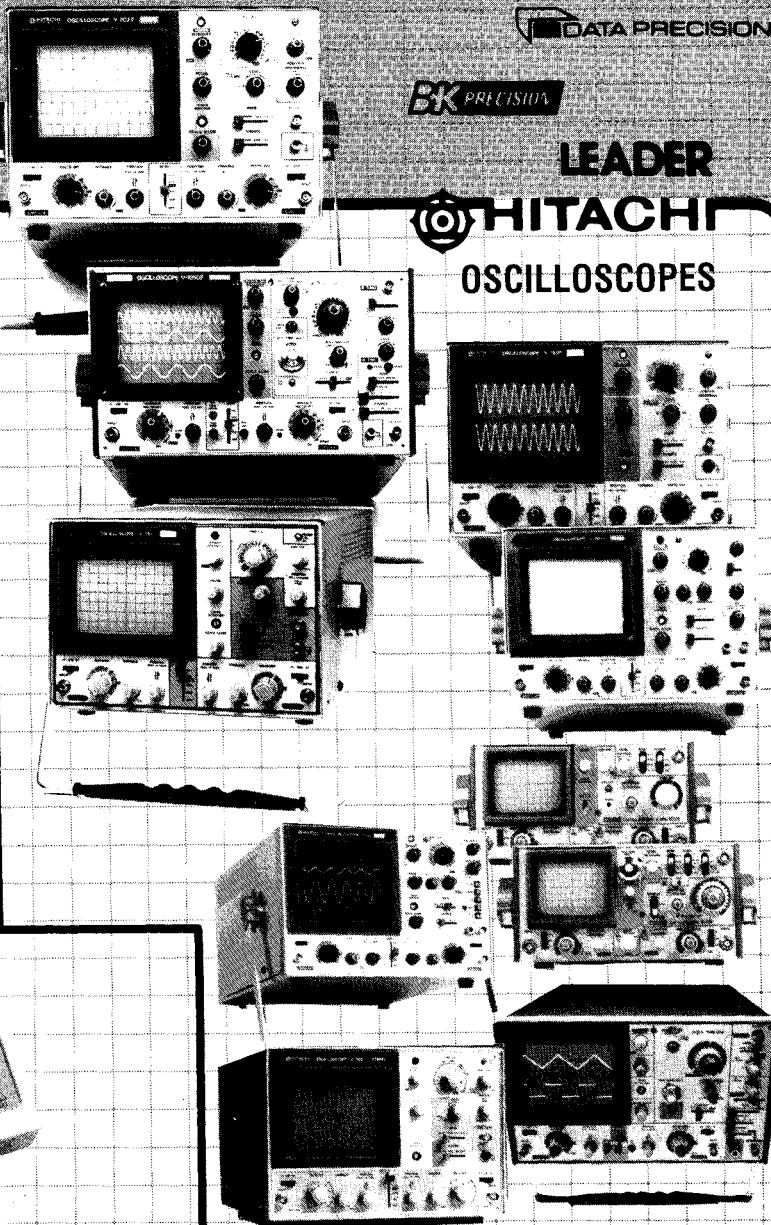
MODEL 4410

BECKMAN
does it again . . . a
true RMS 4½ DMM
w/1 year calibrated
cycle at a 3½ digit
price.

\$239⁰⁰

AVAILABLE NOW!

DC V	200mV, 2V, 20V, 200V, 1500V	.06%
AC V	200mV, 2V, 20V, 200V, 1000V	±0.5%
DC A	200µA, 2mA, 20mA, 200mA, 2A, 10A	0.3%
AC A	200µA, 2mA, 20mA, 200mA, 2A, 10A	0.8%
Ω	2K, 20K, 200K, 2M, 20M	±0.1%

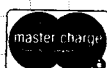


V134	10 MHz	Dual Trace	Storage
V202	20 MHz	Dual Trace	
V203	20 MHz	Dual Trace	w/delay sweep
V209	20 MHz	Dual Trace	Portable
V352	35 MHz	Dual Trace	w/delay line
V353	35 MHz	Dual Trace	w/delay sweep
V509	50 MHz	Dual Trace	Portable
			w/delay sweep
V650	60 MHz	Dual Trace	w/delay sweep
V1050	100 MHz	Quad Trace	w/delay sweep

All in Stock Ready for immediate shipment.
CALL FOR OUR PRICES

ORDERING
INFORMATION

We don't just take
orders, we ship them
Advance Electronics
endeavors to keep everything
we advertise in stock for
immediate delivery.



- Mastercharge & Visa shipped within 24 hours.
 - Bank checks or Money Orders shipped within 24 hours.
 - Personal checks — please allow 3 weeks for check to clear.
 - All prices plus shipping charges. Please call for appropriate charges. Use our toll free number.
 - New York State residents add appropriate sales tax.
 - PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
- Quantities are limited

HITACHI



Non-Linear Systems

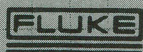
HICKOK

WESTON



DATA PRECISION

KEITHLEY



TRIPLETT



PHILIPS

BK PRECISION



LEADER



HITACHI

A 30 MHz SCOPE AT A 15 MHz PRICE

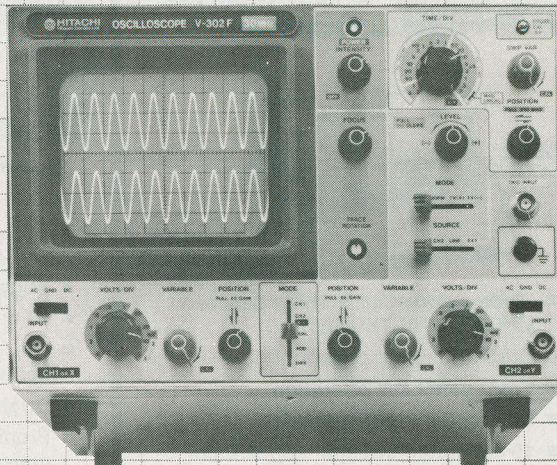
WE CARRY
A FULL LINE
OF HITACHI
OSCILLOSCOPES
•
CALL FOR
OUR PRICES

\$549⁹⁵

V-302

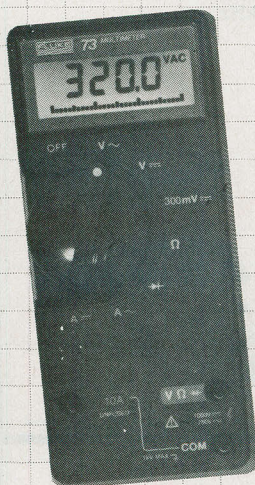
Dual Trace w/Delay

All Hitachi Oscilloscopes feature
2 year parts and labor warranty.



Price does not include probes.
Probes \$50. a pair when purchased with
scope. \$10. shipping within continental U.S.

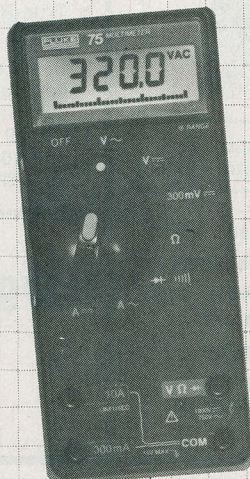
- Mastercharge & Visa shipped within 24 hours.
- Bank checks or Money Orders shipped within 24 hours.
- Personal checks — please allow 3 weeks for check to clear.



73

\$85⁰⁰

- 0.7% Accuracy
- Autorange Only
- 10 Amp Only



75

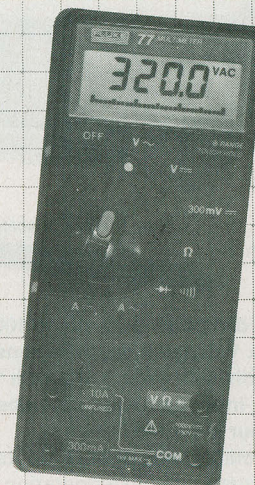
\$99⁰⁰

- 0.5% Accuracy
- Manual or Autorange
- 10A + 300 mA Range
- Beeper

FLUKE 70

SERIES
MULTIMETERS

- Analog Display • Rotary Knob
- Volts AC & DC • Resistance to 32 MΩ • 10 Amps • Diode Test
- 3200 Counts • Fast Autoranging
- Function Annunciators in Display
- Power-Up Self Test • 2000+ Hour Batter Life w/ Power Down "Sleep Mode" • New Test Leads • VDE & UL Approval



77

NEW AVAILABLE NOW! \$129⁰⁰

- 0.3% Accuracy
- Manual or Autorange
- 10 A + 300 mA Range
- Beeper
- "Touch-Hold" Function



TOLL FREE HOT LINE
800-223-0474

THE TEST EQUIPMENT SPECIALISTS

26 WEST 46th STREET, NEW YORK, N.Y. 10036 212-730-7030

ADVANCE ELECTRONICS

HITACHI



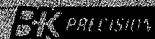
Non-Linear Systems

HICKOK

WESTON

DATA PRECISION

KEITHLEY



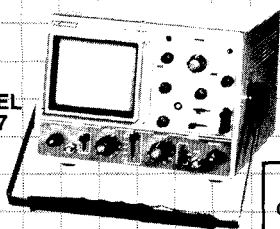
VIZ R&B

TRIPLETT



LEADER

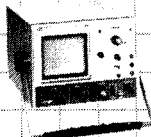
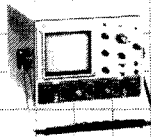
BK PRECISION

15 MHz TRIGGERED
SWEEP SCOPEMODEL
1477CALL FOR
OUR PRICE

- Mode automatically shifts between CHOP and ALTERNATE
- Bright P31 blue phosphor
- Front-panel X-Y operation
- Differential input capability
- 19 calibrated sweeps— $5\mu\text{SEC}/\text{cm}$ to $.5\text{SEC}/\text{cm}$
- Sweep to $.1\mu\text{SEC}/\text{cm}$ with 5x; $1.5\text{SEC}/\text{cm}$ with uncalibrated vernier

BK PRECISION

10 MHz SCOPES

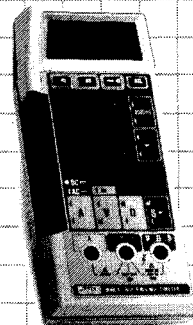
1466
SINGLE
TRACE1476
DUAL
TRACECALL FOR
OUR PRICES

- Triggered and automatic sweep
- 18 calibrated sweeps
- On 1476 mode automatically shifts between CHOP and ALTERNATE
- Bright P31 blue phosphor
- Front panel X-Y operation using matched vertical amps
- Video sync separators
- Check most digital logic circuitry

FLUKE

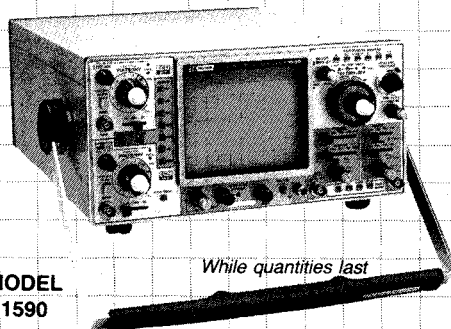
4 1/2 DIGIT
MULTIMETERS

MODEL 8060A

\$349⁰⁰

- Frequency measurements to 200KHz
- dB measurements
- Basic dc accuracy 0.04%; $10\mu\text{V}$, 10nA and $10\text{m}\Omega$ sensitivity.
- Relative measurements
- True RMS
- High-speed Beeper

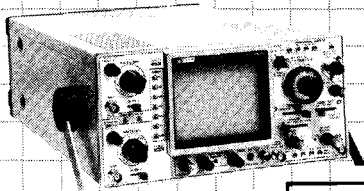
BK PRECISION

100MHz Dual Time
BASE SCOPEMODEL
1590

While quantities last

- $1\text{mV}/\text{division}$ sensitivity to 100MHz
- $500\mu\text{V}/\text{division}$ cascade sensitivity
- $2\text{ns}/\text{division}$ sweep rate with $10\times$ magnifier
- Four-input operation provides trigger views or four separate inputs
- Selectable $1\text{M}\Omega$ or 50Ω inputs
- Alternate timebase operation
- 20MHz bandwidth limiter for best view of low frequency signals
- Lighted function pushbuttons employing electronic switching with non-volatile RAM memory
- Switching power supply delivers best efficiency and regulation at lowest weight
- Selectable frequencies for chop operation

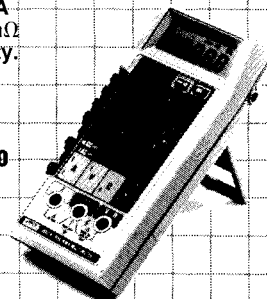
BK PRECISION

70 MHz. Dual Time
BASE SCOPEMODEL
1570CALL FOR
OUR PRICE

- $1\text{mV}/\text{division}$ sensitivity to 70 MHz
- $500\mu\text{V}/\text{division}$ cascade sensitivity
- Four-input operation provides trigger view on 4 separate inputs.
- Alternate time base operation
- Switching power supply delivers best efficiency and regulation at lowest weight

- Continuity and relative reference functions identical to 8060A.
- True RMS measurements to 30 kHz.
- Basic dc accuracy 0.05%; $10\mu\text{V}$, 10nA and $10\text{m}\Omega$ sensitivity.
- Beeper

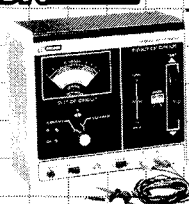
MODEL 8062A

\$279⁰⁰

BK PRECISION

INDUSTRIAL
TRANSISTOR
TESTER\$199⁹⁵

WAS \$249.

MODEL
520B

- Now with HI/LO Drive
- Works in-circuit when others won't
- Identifies all three transistor leads
- Random lead connection
- Audibly and visually indicates GOOD transistor

ORDERING
INFORMATION

We don't just take orders, we ship them
Advance Electronics
endeavors to keep everything
we advertise in stock for
immediate delivery.



- Mastercharge & Visa shipped within 24 hours.
 - Bank checks or Money Orders shipped within 24 hours.
 - Personal checks — please allow 3 weeks for check to clear.
 - All prices plus shipping charges. Please call for appropriate charges. Use our toll free number.
 - New York State residents add appropriate sales tax.
 - PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
- Quantities are limited

Non-Linear Systems, Inc.
OSCILLOSCOPES

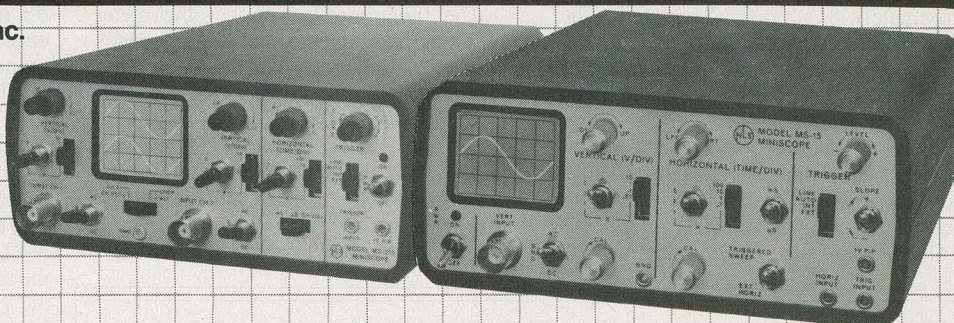
MS15 15 MHz

Single
Trace

MS215 15 MHz

Dual
Trace

MS230 30 MHz

Dual
Trace

Non-Linear Systems' trio of miniscopes are accurate, affordable, portable. And there's one to match nearly every budget and need. Standard features on all models include an input impedance of 1 megohm with 50 pF; maximum input voltage of 350 V; trigger modes in auto, internal, external and line; slope that's + or - selectable; graticule (4 x 5 division of 0.25" each); dual power sources operating either internally from rechargeable lead acid batteries or externally from 115 VAC or 230 VAC (50-60 Hz) via plug-in transformer; handy size (2.9"H x 6.4"W x 8.0"D) and weighs just 3 lbs.*

*(Exception: model MS-230 is slightly deeper, at 8.6", and heavier, at 3.6 lbs.).

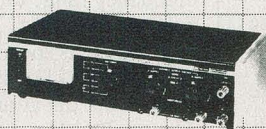


POWER SUPPLIES

MODEL
1601\$299⁹⁵

WAS \$359.

- Isolated 0-50VDC, continuously variable; 0-2A in four ranges
- Fully automatic shutdown, adjustable current limit
- Perfect for solid state servicing

MODEL
1650\$319⁹⁵
WAS \$390.

- Functions as three separate supplies
- Exclusive tracking circuit
- Fixed output 5VDC, 5A
- Two 0 to 25VDC outputs at 0.5A
- Fully automatic, current-limited, overload protection

BECKMAN'S CIRCUITMATE

AVAILABLE NOW
ALL UNDER \$100

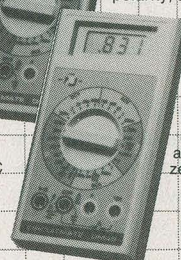
Circuitmate DM 20—3½-digit, pocket-size multimeter; 0.8% Vdc accuracy, diode test, hFE test, conductance, 10 amps AC and DC ranges, auto-polarity, auto-zero, auto-decimal

\$64⁹⁵

Circuitmate DM 25—3½-digit, pocket-size multimeter; 0.5% Vdc accuracy, diode test, capacitance, continuity beeper, conductance, 10 amps AC and DC ranges, auto-polarity, auto-zero, auto-decimal

\$79⁹⁵

Circuitmate DM 40—3½-digit multimeter; 0.8% Vdc accuracy, diode test, auto-polarity, auto-zero, auto-decimal

\$69⁹⁵

Circuitmate DM 45—3½-digit multimeter; 0.5% Vdc accuracy, diode test, continuity beeper, 10 amps AC and DC ranges, auto-zero, auto-polarity, auto-decimal

\$89⁹⁵

FUNCTION GENERATORS



MODEL 3010

- Sine, square and triangle output
- Variable and fixed TTL outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 1 Hz to 100kHz

MODEL 3010
\$179⁹⁵
WAS \$229.MODEL 3020
\$319⁹⁵
WAS \$394.SWEEP FUNCTION
MODEL 3020

- Four instruments in one package—sweep generator, function generator, pulse generator, tone-burst generator
- Covers 0.02Hz-2MHz
- 1000:1 tuning range
- Low-distortion high-accuracy outputs



CAPACITANCE METERS



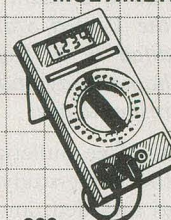
MODEL 830

- Automatically measures capacitance from 0.1pF to 200mF
- 0.1pF resolution
- 0.2% basic accuracy
- 3½ digit LCD display

\$189⁹⁵
WAS \$238.\$159⁹⁵
WAS \$192.

MODEL 820

- Resolves to 0.1pF
- 4 digit easy-to-read LED display
- Fuse protected against charged capacitors
- Overrange indication

BECKMAN
DIGITAL
MULTIMETERS300 310 320
330 350 360ALL IN STOCK
CALL FOR PRICESTOLL FREE HOT LINE
800-223-0474

THE TEST EQUIPMENT SPECIALISTS

26 WEST 46th STREET, NEW YORK, N.Y. 10036 212-730-7030

ADVANCE
ELECTRONICS

EQUIPMENT REPORTS

continued from page 26

The instrument, which is AC powered, is housed in a cabinet that measures approximately $8 \times 7 \times 2\frac{1}{2}$ inches. The front panel is divided into two sections. On the left side is a combination digital frequency/level meter. It features the LED display, the main power switch, a DB/FREQ meter-function selector, and a standard phone jack that serves as the input for the digital meter. The input impedance for the meter is 100,000 ohms.

On the right side of the panel are the

controls for the sinewave generator. It has a frequency-selector knob with "ballpark" calibrations at 20, 100, 1000, 5000, 10,000 and 20,000 Hz, an uncalibrated output-level adjustment, and a standard phone jack for the output. Its output impedance is 50 ohms.

The function switching of the meter between the frequency and level modes is partially automatic. When there is no plug inserted in the meter's input jack the digital meter is automatically connected to the signal generator's output jack; and depending on the setting of the DB/FREQ function switch, the meter indicates either the generator's frequency or the output level in dBV, or whatever reference level

the user prefers. As shipped from the factory, a 0-dB (referenced to 1 milliwatt in a 600-ohm circuit) meter reading represents 0.775-volts RMS, the communications industry's reference level. However, a trimmer-potentiometer adjustment on the rear apron permits the user to set the 0-dB meter reading to any preferred reference level. For example, if the 1000-Hz output level is set for a "user reference level" of 0.32V ($V = 1$ volt reference level), the trimmer can be adjusted so the meter indicates 0 dB instead of the actual -10 dB.

When the test lead's plug is inserted into the meter jack both the frequency and level metering-functions are switched to the test leads. Depending on the setting of the DB/FREQ selector switch, the digital meter will display either the frequency of the incoming signal or the input level in dBV. If the meter has been recalibrated by the user to indicate 0 dB for an other than standard output level, the same calibration is in effect for input-test measurements. In that way, both input and output are standardized to the user's, or the system's, so-called "0 dB reference level".

The specifications checked out either as claimed or better. The actual oscillator frequency range turned out to be 14 Hz to just under 30 kHz. The output-level variation, which is specified at ± 0.25 dB from 20 Hz to 20 kHz, checked out no greater than ± 0.1 dB at any frequency from 20 Hz to 29 kHz. One note of caution, however. When working at very low frequencies the user must take care to shift frequencies from high to low. That's because there are severe low-frequency level-settling variations of up to ± 5 dB if output frequencies below 50 Hz are adjusted starting at "0 Hz" (full counter-clockwise setting of the frequency control). When coming in from the high side there is virtually no variation in output level as the output frequency is adjusted below 50 Hz. The situation would normally not be of any concern except when feeding high-level low-frequency tones through loudspeakers.

The meter range, which is specified at -50 to $+24$ dB (where 0 dB = 0.775 volts), checked out precisely, as did the "0 dB" reference adjustment range of -10 to $+8$ dBV. The frequency-meter mode functions as long as the input signal falls within the range of -40 dB to $+24$ dB. Since the dB meter function is logarithmic there is no function selector or indicator; the level is whatever is displayed. The meter mode is indicated by LED's in the display.

The meter is supplied with a notably good manual showing typical uses for the meter and excellent and unusual tips on making audio measurements.

A minor inconvenience is the frequency-selector control. Since it encompasses the full audio bandwidth—a 1000:1 ratio—setting a precise frequency is a lit-

continued on page 38

Where's Your **ELECTRONICS CAREER** Headed?

Put Professional Knowledge and a
COLLEGE DEGREE
in your Electronics Career through

**HOME
STUDY**

**Earn Your
DEGREE**

No commuting to class. Study at your own pace, while you continue on your present job. Learn from easy-to-understand lessons, with help from your instructors when you need it.

Grantham has been training students for electronics degrees longer than any other home-study, independent-study, or correspondence institution. *Grantham is the only school in the United States offering an accredited B. S. Degree in electronics by home study, independent study, or correspondence.*

Our free bulletin gives full details of the home-study program, the degrees awarded, and the requirements for each degree. Write for our free

Bulletin 11-83.

Grantham College of Engineering is a specialized institution catering to mature individuals who are employed in electronics and allied fields such as computers. The field of electronics is so enormous that opportunity for advancement is always present. Promotions and natural turnover make desirable positions available to those who are prepared to move up!

Advancement in electronics is made easier and more certain by (1) superior knowledge, and (2) documentation of that knowledge. Grantham specializes in making both 1 and 2 as listed above available to you.

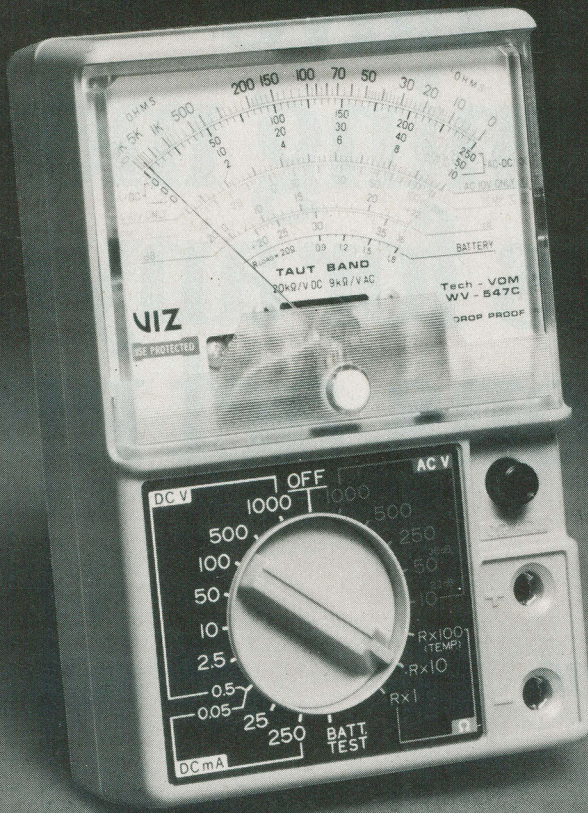
Grantham's home-study program leading to the

B. S. DEGREE

may fill an important need for you. This is a comprehensive correspondence program in which you first review some things you already know, in preparation for the studies that come later. Some previous knowledge in the field is presumed, but is thoroughly reviewed in depth, so as to give you a thorough foundation for the level of studies you have not previously undertaken. Even though some students hold associate degrees before enrolling, an A. S. Degree is awarded along the way toward the B. S. Degree.

For full information, write for Bulletin 11-83.

Grantham College of Engineering
2500 So. La Cienega Blvd.
P. O. Box 35499
Los Angeles, CA 90035



NEW Tech VOM WV-547C

Drop-proof. Fuse protected.
High impact ABS plastic case.

Rugged,
accurate taut-band meter.

Sensitivity
20,000 ohms-per volt DC
9,000 ohms-per volt AC

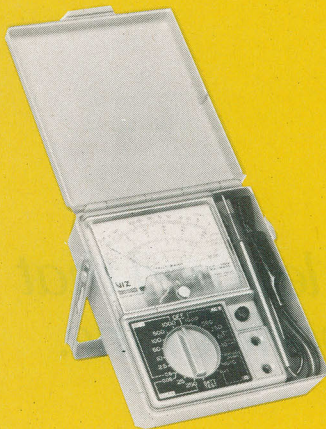
21 color coded ranges.

Snap action,
dual detent range switch.

Temperature scale
(optional accessory)

User oriented
"right angle" test leads.

For \$35.⁵⁰ Here's your best VOM value.



It's compact, drop-proof (3 feet) and provides 21 color-coded ranges—volts, milliamps, ohms, temperature scale and decibels. True quality instrument for your portable applications. Tough, accurate, taut-band meter, fuse-protected. Sensitivity 20,000 ohms/volt DC. High-impact case, colored bright orange. Snap action, dual-detent range switch. Range limits: 1000V DC and AC, 250 mA DC, one megohm, +200°C. Battery Test provision. Meter OFF position. Temperature scale (special probe optional).

WV-547D. Same instrument in impact-resistant carrying case. Handle converts to tilt stand.

\$39.95

Want full technical details and a demonstration? Call toll-free, 1-800-523-3696, for the VIZ distributor near you.

VIZ

**Look to VIZ for value, quality, availability.
Over 70 instruments in the line—PLUS full accessories.**

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144

CIRCLE 91 ON FREE INFORMATION CARD

If you have put off learning more electronics for any of these reasons, act now!

☐ *I don't have the time.*

☐ *High school was hard for me and electronics sounds like it may be hard to learn.*

☐ *I can't afford any more education.*

☐ *I have a family now.*

☐ *I'm here. You're there. I've never learned that way before. I'm not sure it will work for me.*

Read the opposite page and see how you can get started today!

Be honest with yourself. Are the reasons really excuses? You already know enough about electronics to be interested in reading this magazine. So why not learn more? If you need encouragement, read on and see how excuses can be turned into results.

You don't have the time.

Be realistic. All you have in life is a period of time. Use it. Try to know more tomorrow than you do today. That's the proven way to success.

Electronics sounds like it may be hard to learn.

You already know something about electronics or you wouldn't be reading this. Now, build on that. CIE Auto-Programmed® Lessons help you learn. Topics are presented in simple, logical sequence. All text is clear and concise for quick, easy understanding. You learn step by step, at your own pace. No classes to attend. Nobody pressures you. You *can* learn.

You can't afford any more education.

Actually, you can't afford NOT to gain the skills that can put you ahead of the others. It makes sense to invest in yourself through education — learning a skill. If you are not able to pay full tuition now, convenient monthly payments can be arranged.

You have a family now.

All the more reason why you have the responsibility to advance yourself. For the sake of your family. Do you want them to have what you had or have *more* than you had? The choice is yours. Electronics is a rewarding career choice. CIE can help you to get started on that career.

You're there. We're here. How does CIE help you learn?

First, we *want* you to succeed. You may study at home, but you are not alone. When you have a question about a lesson, a postage stamp gets you your answer fast. You may find this even better than having a classroom teacher. CIE understands people need to learn at their own pace. When CIE receives your completed lesson before noon, it will be graded and mailed back to you the same day with appropriate instructional help. Your satisfaction with your progress comes by return mail. That's how CIE helps you learn.

NOW, IF YOU AGREE CIE TRAINING CAN WORK FOR YOU, HOW ELSE CAN CIE HELP YOU?

CIE is one of the largest independent home study schools in the world that specializes in electronics. Although "big" does not always mean "best," it is evidence that CIE is a strong, successful institution with the people and resources to help you succeed.



Step-by-step learning includes "hands-on" training.

The kind of professional you want to be needs more than theory. That's why some of our courses include the Personal Training Laboratory, which helps you put lesson theory into actual practice. Other courses train you to use tools of the trade such as a 10MHz, solid-state, triggered-sweep oscilloscope. Or a Digital Learning Laboratory to let you apply the digital theory that's essential today for anyone who



wants to keep pace with electronics in the eighties. Or a Microprocessor Training Laboratory you learn to program and interface with displays, memories, switches, and more.

Your credentials can impress employers.

One of the best credentials you can have in electronics — or any other career field — is a college degree. That's why CIE gives you the opportunity to earn an Associate in Applied Science in Electronics Engineering Technology. Any CIE career course can offer you credit toward the degree...more than half the number needed in some cases.

You can also prepare for the government-administered FCC (Federal Communications Commission) Radiotelephone License, General Class. It can be a real mark in your favor...government-certified proof of your specific knowledge and skills.

Find out more! Today. Now.

There's a card with this ad. Fill it in and return. If some other ambitious person has already removed it, use the coupon.

You'll get a copy of CIE's free school catalog, along with a complete package of personal home study information.

For your convenience, we'll try to arrange for a CIE representative to contact you to answer any questions you may have.

If you are serious about a rewarding career, about learning electronics or building on your present skills, your best bet is to go with the electronics specialists — CIE. Mail the card or coupon today or write CIE (please mention the name and date of this magazine), 1776 East 17th Street, Cleveland, Ohio 44114.

This could be the best decision you've made all year.

CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114

Accredited Member National Home Study Council

YES...I want to learn from the specialists in electronics — CIE. Send me my FREE CIE school catalog...including details about the Associate Degree program... plus my FREE package of home study information.

Print Name _____

Address _____ Apt. _____

City _____ State _____ Zip _____

Age _____ Area Code/Phone No. _____ / _____

Check box for G.I. Bill bulletin on Educational Benefits: ☐ Veteran ☐ Active Duty

MAIL TODAY!

RE-72

EQUIPMENT REPORTS

continued from page 32

tle tricky because just a light touch on the control knob can produce a substantial shift in frequency. That is typical of just about every kind of signal generator or oscillator with a 1000:1 frequency adjustment, but it does lead to a more serious complaint, the semi-automatic meter-function selection.

To describe the semi-automatic meter switching as inconvenient is an understatement. If there is any question about the oscillator's level or frequency, or it is necessary to readjust either the oscilla-

tor's level or frequency, pulling the plug connected to the meter's test leads is not the easiest nor most convenient way to do it. There should be an input/output meter-selector switch on the front panel; a push-switch isn't all that expensive.

But inconveniences notwithstanding, the Loftech TS-1 can often prove the best low-cost way to do a job easily and with the least fuss. While the test set is not a "full-function" instrument, in most instances it does permit notably quick and accurate frequency checks and adjustments to audio systems, equalizers, and communications lines. Most important, its readings and adjustments can be trusted. It sells for \$299.00

R-E



GET A GRIP ON ROBOTICS WITH SAMs.

Grab onto these Sams Books from Mark Robillard and get a jump on robotics programming.

MICROPROCESSOR BASED ROBOTICS starts by explaining the mechanics of robot hands, arms and legs, and leads into tactile, motion and attitude sensing, even vision systems. Learn system controlling through microprocessors and BASIC programming, plus much more. It's an informative non machine-specific book that is an excellent introductory guide. No. 22050, \$16.95.

HERO 1: ADVANCED PROGRAMMING & INTERFACING moves beyond the technical manuals with a series of advanced experiments and applications. Discusses machine and robot language, building and installing both local and remote interfaces, operating system enhancements, and other select programming techniques. No. 22165, \$16.95.

Program your own success by ordering these Sams Books today. Call 800-428-3696 or 317-298-5566 and ask for Operator 469.

SAMS BOOKS AND SOFTWARE

HOWARD W. SAMS & CO., INC.
4300 West 62nd Street • P.O. Box 7092
Indianapolis, IN 46206

HERO 1 is a trademark of the Heath Corporation.

Offer good in USA only and expires 3/31/84. Prices subject to change without notice. In Canada, contact Lenbrook Electronics, Markham, Ontario L3R 1H2.

AD469

CIRCLE 32 ON FREE INFORMATION CARD

Fluke Model 77 DMM



CIRCLE 104 ON FREE INFORMATION CARD

Fluke	Model 77									
OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE/VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair			Good			Excellent	

WHEN SHOPPING FOR A PORTABLE DMM there are several things you should look for. Those are reliability, ease of use, and ruggedness; it would also be nice if the unit sold for a reasonable price. We recently had a chance to examine a device that meets all of those criteria; it is the Fluke (PO Box C9090, Everett, WA, 98206) model 77 DMM. In addition, however, that meter is packed with a variety of features, including autoranging, automatic display blanking (to prolong battery life), both digital and analog readouts, and a touch-hold function that locks in a reading on the display. Considering all of that, this is quite an extraordinary instrument; we would like to tell you more about it.

The model 77 is an attractive, compact device. It measures 1.12 x 2.95 x 6.55 inches and weighs 10 ounces. The front panel is simplicity itself, consisting of just the display, a single rotary switch, a RANGE switch (more on that later), and four test lead jacks. The jacks are of the type in which there is no exposed metal; that greatly reduces the chance of an accidental shock. The rotary switch is used to turn the unit on and off, and to select the function desired; the RANGE button is located at the center of that switch.

Specifications

Let's look at the meter's specifications. It will measure DC voltage over five

State-of-the-Art VIDEO EQUIPMENT

Quality • Low Prices • Immediate Delivery

SPECIAL!



MODEL V-1880

**BP STABILIZER/IMAGE ENHANCER/
RF CONVERTER/VIDEO FADER/2-WAY
DISTRIBUTION AMPLIFIER**

\$119⁹⁵

OUR PRICE

Contains five units in one; stabilizer (video guard remover); image enhancer; video to RF converter; video fader; and dual output distribution amplifier. **Stabilizer** Will correct entire range of copy guard distortion such as jitter, vertical roll or black bar travelling through picture.

Enhancer Attain best picture for your preference.

RF Converter Allows your TV set to receive video and audio signals from your image enhancer, guard stabilizer, video camera, computer, VCR, etc. The direct video signal from any video component can be fed into the V-1880 and converted to a usable RF signal that can go to your TV antenna terminals.

Video Fader Used to produce fade ins and outs.

NEW!



MODEL V-2250

**BP TV TO STEREO
AUDIO ADAPTOR/
ENHANCER \$17⁹⁵**

OUR PRICE

Easily connects to any TV and Stereo Amplifier or simulated stereo sound. Makes taping TV Audio simple - TV can be located any distance from stereo. Delivers two channels of simulated stereo. With noise eliminator and special output level controls. Frequency response: 50 Hz - 15,000 KHz.

NEW!

**BP VIDEO COLOR PROCESSOR/RF CONVERTER/
STABILIZER/3-WAY DISTRIBUTION AMPLIFIER**

OUR PRICE

\$189⁹⁵

Corrects video signal directly into tape not just on playback. Luminance meter monitors brightness levels for quality recordings. Can also be used between video cameras and VCR, VCR and VCR and from VCR to TV during playback mode. Corrects off-color tapes. Center detent, luminance, chroma, phase and audio controls. Stabilizer for removing copyguard.



MODEL V-1890

**BP VIDEO GUARD STABILIZER
MODEL V-1875**



OUR PRICE \$45⁰⁰

Has self contained A&B and bypass switch. Many movies, concerts and special programs for sale or rental are copy guarded. This removes copy guard and allows you to make copies. Many TV sets will not play prerecorded tapes because copy guard causes picture to roll and jitter, turn to snow or disappear. Video Guard Stabilizer removes copy guard from signal.

**BP RF CONVERTER/MODULATOR
MODEL V-1885**

OUR PRICE \$39⁹⁵

Allows your TV to receive video and audio signals from image enhancer, guard stabilizer, video camera, computer, VCR, etc. The outputs of many video components cannot be directly hooked up to the VHF antenna terminals on your TV set. This problem is solved by using the Model V-1885 RF Converter. Converts video signal from any video component to adjustable RF signal at antenna terminals. Allows your VCR output to feed two TV sets at the same time, with virtually no signal loss.



**BP VIDEO SELECTOR CENTER
MODEL V-4803**

OUR PRICE \$49⁹⁵

A switcher that can accept 6 inputs and direct them to 3 outputs. Utilizes switch similar to one used on home VCR's. You avoid signal loss incurred by using splitters.



**PHILIPS/MAGNAVOX
REMOTE TV CONVERTER
MODEL CTC9R**

OUR PRICE \$125⁰⁰

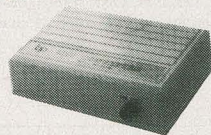
60 Channel selection. Infrared transmitter system for impedance free operation. On/Off, change channels, fine tune. Programmable 12 hour clock with Auto and PM indication. Channel memory and recall.



**BP UHF CABLE CONVERTER
WITH FINE TUNING/46 CHANNEL
MODEL V-5746**

OUR PRICE \$24⁹⁵

Fully shielded oscillator eliminates hearing bone distortion. For Beta/VHS recording. Record & use TV's remote control. Complete programming of VTR.



**BP VIDEO GUARD STABILIZER/
RF CONVERTER
MODEL V-1877**



OUR PRICE \$69⁹⁵

Same as V-1875 but with a built-in RF Converter that gives the model V-1877 an RF output which can be fed directly to the antenna terminals of a TV set. This enables you to remove the copy guard from a pre-recorded tape and view it on a TV using only a VCR.

Use as an RF Converter only. Used in conjunction with your TV, you can feed direct audio and video signals from any video device such as video camera, computer, portable VCR, etc.

**BP IMAGE ENHANCER
MODEL V-1860**

Dramatically improves performance of video cameras and VCR's (off-the-air or second generation recordings), by compensating for deterioration of detail and sharpness. Includes video distribution amplifier with two video outputs.



OUR PRICE \$59⁹⁵

FORDHAM

260 Motor Parkway, Hauppauge, N.Y. 11788

Master Charge
VISA COD
Money Order
Check

N.Y. State
residents add
appropriate
sales tax.

COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE
\$251.00 to \$500.00 \$4.50
\$501.00 to \$750.00 6.50
\$751.00 to \$1000.00 12.50
over \$1000.00 15.00

TOLL FREE (800) 645-9518
in N.Y. State call 800-832-1446

ranges; those are 320-millivolts and 3.2-, 32-, 320-, and 1000-volts full scale. Claimed sensitivity is 0.1 millivolt (320-millivolt range) and accuracy in the worst case (1000-volt range) is 0.4% + 1 digit. AC voltage is measured over four ranges—3.2-, 32-, 320-, and 750-volts full scale. Sensitivity is claimed to be 1 millivolt, and the accuracy is 2% + 1 digit. AC and DC current is read over three ranges—32-milliamps, 320-milliamps, and 10-amps full scale. The sensitivity is as high as 0.1 milliamp, and the accuracy is between 1.5% + 2 digits to 3% + 2 digits, depending on the range. Finally, resistance is measured over six ranges. Those are 320-, 3200-, 32,000-, and 320,000-

ohms, and 3.2- and 32-megohms. Sensitivity is claimed to be 0.1 ohm (320-ohm range), and the accuracy is better than 2% + 1 digit.

There is also a diode-test/continuity-test function. For continuity testing, a tone sounds whenever the measured resistance is less than 150 ohms. For the diode test, the meter displays the measured forward voltage drop (up to 2 volts) and beeps briefly for one diode drop (.7 volts). If a continuous tone sounds, the diode is either reverse biased or open.

If you've been paying attention, you've probably noticed something strange about the ranges we've described. In most 3½-digit DMM's the typical range will be

from 0 to 1999 (with appropriate placement of the decimal point). Here, many of the ranges run from 0 to 3200 (again with appropriate placement of the decimal). What that means is that the meter has greater resolution per range. In fact, the resolution rivals that of much more expensive 4½-digit DMM's. As a result, if the measurement is, say, 24.05 volts, that's what you'll see, not 24.0 as would be typical.

Use

It's hard to imagine a DMM that's easier to use than the model 77. To operate, all you have to do is select a function with the rotary switch and perform the test. You don't even need to worry about the polarity of the measurement or zeroing the probes—that is taken care of by the meter. In addition, range selection is not necessary as the unit is an autoranging one. If you wish, the autoranging can be defeated by a touch of the RANGE switch. Pressing that switch repeatedly steps the meter through the ranges, including proper placement of the decimal point. When a range is selected, all further measurements are made on it. To return to autoranging, the rotary switch is turned to another function and then back.

When the unit is first turned on (again with the rotary switch) the meter goes through a quick two-second self-test sequence. During that time all critical functions, the battery, and the display, including all annunciators, are tested. If everything is OK, the meter chirps and you are set to go.

Readout

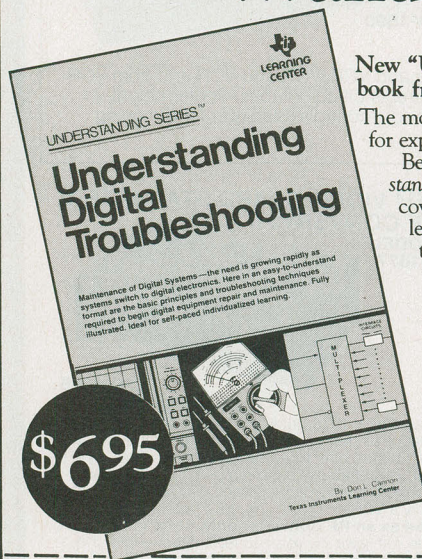
We've already mentioned one way in which the readout on this meter differs from the norm—its ability to display values greater than 1999. It differs in another way, however, that is even more significant. As nice as DMM's are, there's one thing you can't do with them that you can with an analog meter: peak or null a circuit. The chief reason for that is the slow response time of a typical DMM—often a second or more. That drawback has been nicely done away with in this meter through the inclusion of an analog bargraph display. That display, located at the bottom of the readout, responds almost instantly to any changes in the measured values.

In addition to the above, the readout contains many of the features we've come to expect in modern meters. A full complement of annunciators includes function, range (indicates when the RANGE button has been pressed) polarity, and low battery.

Touch-hold

If you ever have had to make a measurement in a tight area, especially when working with high-voltage or delicate circuitry, you know how critical probe placement can be. The last thing you need is to

Look for trouble ...and find it.



New "Understanding Digital Troubleshooting" book from TI.

The move is on to digital circuits, increasing the need for expert maintenance and repair troubleshooting.

Before trouble finds you, get the new TI Understanding Series Digital Troubleshooting book. The book covers basic concepts and operating principles and leads you through to accurate troubleshooting techniques.

This 264 page book is filled with the latest information, clear illustrations and self-help tests. It's everything you need to find trouble in digital systems.

Order your copy today.

TEXAS INSTRUMENTS

Creating useful products
and services for you.

Please send me:

Understanding Series™ Titles:

- ☐ Understanding Digital Troubleshooting — (LCB8036)
- ☐ Understanding Solid-State Electronics — 3rd edition (LCB3361)
- ☐ Understanding Digital Electronics — (LCB3311)
- ☐ Understanding Microprocessors — (LCB4023)
- ☐ Understanding Calculator Math — (LCB3321)
- ☐ Understanding Communications Systems — (LCB4521)
- ☐ Understanding Computer Science — (LCB5471)
- ☐ Understanding Optonics — (LCB5472)
- ☐ Understanding Automotive Electronics — (LCB5771)
- ☐ Understanding Electronic Security Systems — (LCB7201)
- ☐ Understanding Electronic Control of Energy Systems — (LCB6642)
- ☐ Understanding Telephone Electronics — (LCB7141)
- ☐ Understanding Electronic Control of Automation Systems — (LCB6641)

Self Study Courses:

- ☐ AC Audio (LCB6651)/AC Text (LCW8168)
- ☐ DC Audio (LCB5922)/DC Text (LCW8161)
- ☐ Learning Center Library Catalog (CM-110L)

Quantity Price

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

_____ @ \$6.95

Mail to:

Texas Instruments
P.O. Box 3640, M/S 54
Dallas, Texas 75285

*Add \$2.50 for postage and handling. Postage prepaid for Understanding Series. Prices subject to change without notice.

Enclose check or money order with sales tax (except AK, DE, NH, OR). Foreign orders must be in U.S. dollars and include shipping charges. No phone orders, please.

Name _____

Address _____

City _____

State _____ Zip _____

72336 © 1983 TI

RE-1183

ANNUAL INVENTORY REDUCTION... TEST INSTRUMENT SALE!

NOT SECONDS, NOT REBUILTS, NOT REJECTS-
ALL ARE BRAND NEW-IN FACTORY CARTONS!
HAVE NOT BEEN USED FOR DEMOS.

	LIST	SALE
HITACHI V-099 WAVE FORM MONITOR	\$1350.	\$1350. SOLD OUT
HITACHI V-089 VECTOR SCOPE	\$1684.	\$1684. SOLD OUT
HITACHI V-152F 15MHZ SCOPE	\$595.	\$468.
HITACHI V-1050F 100MHZ SCOPE	\$1980.	\$1589.
HITACHI V-151F 15MHZ SCOPE	\$495.	\$388.
HITACHI V-202F 20MHZ SCOPE	\$695.	\$546.
HITACHI V-650F 60MHZ SCOPE	\$1195.	\$1195. SOLD OUT
HITACHI V-302F 30MHZ SCOPE	\$799.	\$665.
BECKMAN TECH300 DMM	\$120.	\$108.
BECKMAN HD-100 DMM	\$169.	\$152.
BECKMAN TECH 310 DMM	\$145.	\$130.
BECKMAN TECH 330 DMM	\$219.	\$197.
BECKMAN TECH 350 DMM	\$229.	\$206.
BECKMAN TECH 360 DMM	\$289.	\$260.
LEADER LBO-514A SCOPE	\$695.	\$589.
LEADER LFG-1300S, FUNCTION GEN.	\$495.	\$419.
LEADER LSG-17, SIGNAL GEN.	\$190.	\$160.
LEADER LAG-27 SINE/SQ. WAVE GEN.	\$205.	\$184.
LEADER LDC-823S FREQ. COUNTER	\$450.	\$405.
LEADER LDC-822 FREQ. COUNTER	\$320.	\$288.
LEADER LBO-524, 35 MHz SCOPE	\$995.	\$848.
VIZ WP-704A POWER SUPPLY	\$139.	\$115.
VIZ WP-702A POWER SUPPLY	\$184.	\$165.
VIZ WP-708 POWER SUPPLY	\$499.	\$399.
VIZ WE-130A SOUND LEVEL METER	\$179.	\$133.
VIZ WA-504B/44D AUDIO GENERATOR	\$184.	\$127.
SIMPSON 7016 COUNTER TIMER	\$447.	\$447. SOLD OUT
SIMPSON 7020 SCALER	\$506.	\$506. SOLD OUT
SIMPSON 420A FUNCTION GEN.	\$204.	\$183.

	LIST	SALE
SIMPSON 452 15 MHZ SCOPE	\$919.	\$827.
SIMPSON 454 15MHZ SCOPE	\$730.	\$657.
SIMPSON 260-7 MM	\$119.	\$103.
SIMPSON 260-7M MM	\$127.	\$114.
SIMPSON 269-3 MM	\$218.	\$196.
SIMPSON 360-2 DMM	\$375.	\$337.
SIMPSON 463 DMM	\$210.	\$174.
SIMPSON 461-2 DMM	\$204.	\$174.
SIMPSON 461-2R DMM	\$246.	\$219.
SIMPSON 464A-3 DMM	\$304.	\$273.
SIMPSON 464D-3 DMM	\$355.	\$319.
SIMPSON 460-5 DMM	\$397.	\$357.
SIMPSON 467-E DMM	\$225.	\$202.
BBC MA3E MM	\$179.	\$161.
BBC MA1H MM	\$49.	\$44.
BBC MA2H MM	\$79.	\$71.
BBC M2011 DMM	\$119.	\$107.
BBC M2012 DMM	\$139.	\$125.
BBC MA5D DMM	\$595.	\$535.
BBC M2030 DMM	\$199.	\$179.
BBC M2031 DMM	\$219.	\$197.
BBC M2032 DMM	\$259.	\$233.
A.W. SPERRY 315P, 15MHZ SCOPE	\$800.	\$720.
A.W. SPERRY 620C, 20MHZ SCOPE	\$785.	\$706.
A.W. SPERRY EZ-6110 DMM	\$168.	\$89.88
A.W. SPERRY SP-10 MINI-METER	\$17.75	\$15.88
A.W. SPERRY SP-15 MINI-METER	\$19.95	\$17.88
A.W. SPERRY SJ-25 MINI-PROBER	\$32.95	\$29.88

ALL ITEMS CARRY FULL MANUFACTURERS
WARRANTY PLUS ELECTRONICS WAREHOUSE
FULL 45 DAY MONEY BACK GUARANTEE!

ELECTRONICS WAREHOUSE

Halls Rd. - P.O. Box 624 - Old Lyme, CT 06371

TERMS: U.S. funds, Visa, Amex, MC, Money Order, Check (allow 2 weeks to clear). CT residents add 7 1/2% sales tax. Sale prices for prepaid orders only. Prices and availability of product subject to change without notice. Write for **free catalog**. C.O.D. orders cash or certified check add \$1.60. Shipping and handling charges add \$3.60 for orders under \$100., add \$7 for orders over \$100. (air freight extra).



TELEPHONE ORDERS FILLED
FAST! ORDER DESK OPEN
FROM 9 AM TO 5 PM E.S.T.
CALL (203) 434-8308

have to keep a watch on your meter's read-out at the same time. Well, with the model 77 you don't have to. That meter's touch-hold function "captures" a reading and displays it until you have a chance to look at it. That allows you to place all your attention on placing the probes. When you here the meter beep, you know that the reading has been captured by the meter. You can then withdraw the probes and examine the reading at your leisure.

The touch-hold function is activated with the RANGE switch. To turn it on, the RANGE switch is held in as the rotary switch is turned to the desired function. The RANGE annunciator on the readout lets you know that the function has been

activated. To deactivate the function, the meter must be turned off.

The meter comes complete with a multipurpose holder. It serves as a shock absorber for rough handling, it holds and stores test leads, it includes a tilt stand, a belt hook for easy carrying, and a neck strap for easy viewing while using the test probes.

The only thing that was the least bit disappointing about the meter was the instruction manual. It offered little more than a brief summary of meter's operation. There's also an operator maintenance section that shows how to test the fuse, perform some simple calibration procedures, replace the fuse and the nine-

volt battery that the meter uses for power (estimated battery life is claimed to be two years), and it gives an abbreviated parts list. In all, the manual covers the material it was intended to well, but it would have been nice to see more information for the technically inclined.

The manual aside, this is a really nice piece of equipment. And to top everything off, it sells for \$125.00, a reasonable price considering that this meter offers just about every feature one would want in a portable DMM. If you are in the market for a DMM, be sure to keep the model 77 in mind.

R-E

ELECTRIFYING VALUE!

Paladin introduces the lowest cost electric desoldering tool in the world: The PA 1707 SOLDER SCOOTER...

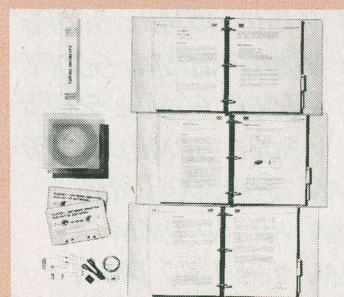
- Solder Scooter heats and desolders; it's the one tool that replaces two.
- Works effectively on single or two-sided PC boards.
- Ceramic substrate heating element begins heating immediately.
- Powerful built-in vacuum pump.
- Solder collector cleans fast.
- Long life tip replaces in seconds.
- Ideal for field and re-work jobs.

**Only
\$22.95**

PALADIN CORPORATION

3543 Old Conejo Road, Suite 102
Newbury Park, California 91320
[805] 499-0318

Heathkit EE3104 Electronics Circuits Course



CIRCLE 105 ON FREE INFORMATION CARD

Heathkit	EE 3104									
OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE / VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good		Excellent			

WHETHER YOU'RE AN ELECTRONICS professional, advanced hobbyist, or just a beginner, the Heathkit (Benton Harbor, MI 49022) EE3104 electronics circuits course is worth a look. The professional will find the refresher course in basic electronic circuit theory worthwhile; while the advanced hobbyist will probably find something new to think about. If the beginner uses it correctly, especially in conjunction with the other three courses in the series, he will get a good basic introduction in electronics theory.

The fourth in a series of structured learning courses in the Heathkit Continuing Education series, it builds upon the theory presented in Heath's DC electronics course, AC course, and semiconductor-devices course. Included is everything needed to successfully complete the program, including the more than 100 components needed for the 18 experiments. Those components include an as-

continued on page 119

Two facts you'll find hard to believe . . .

1. **This phone, with engineering for the year 2001, is yours right now.**
2. **Your cost is only \$99.95.**

Some of the brightest electronic engineers in the world decided to build a telephone that makes all others obsolete.

This phone would have a **big** memory to remember (and dial with one or two buttons) a lot of phone numbers.

It would handle one or two lines, with a "hold" button, for big-phone performance and convenience.

It would work with rotary pulse or Touchtone®, so you can use it to talk to a computer or to use MCI, Sprint, or any of the tone-code long distance services.

It would display the number being dialed in LED-illuminated figures, to prevent errors even in the dark.

Most of all —

It would be beautiful, a magnificent sleek instrument to enhance any room.

Ladies and gentlemen, we give you...

The Electronic Secretary-Phone

Every other state-of-the-art phone we've seen handles either just one line or (bulkily) five lines.

The ELECTRONIC SECRETARY-PHONE is about half the size of most phones, but its innards are crammed with advanced electronic technology.

What a timesaver! It "remembers" up to 32 numbers! Enter them just once — then call any of them by pushing one or two buttons.

Two-In-One, with "Hold" Button

You control two separate phone lines, which means you can have a true multi-line conference call without involving the phone company.

Talk on Line 1; or put the call on Line 1 on hold while you talk on Line 2; or tie both lines together by depressing both buttons!

Best of all, you can touch one key and you'll have a hands-free speakerphone whose sound fidelity is surprising. Your phone has a volume control, of course.

Before we tell you how little it costs, here a few more timesavers and conveniences built into your Electronic Secretary-Phone:

Elegant, Expensive-Looking, Easy!

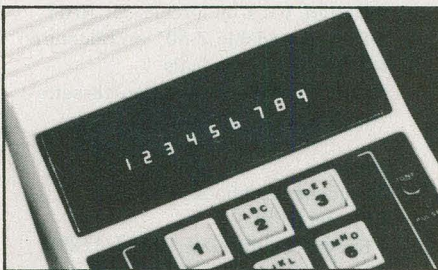
We've seen phones you need an engineer's degree to operate. A child will have no trouble putting this wonder-phone through its paces.

You won't dial a wrong number because an LED display shows you, digitally, the number you're calling.

You can call MCI, Sprint, your computer, or anywhere you need the touchtone signal. A touch of your finger switches back and forth from pulse to touchtone.

Automatic redialling of the last number? Of course. No jangling ringer-bell; the ringer is a pleasant electronic tone.

But we think what you'll like most about the Electronic Secretary-Phone is its beauty. If ever a phone could win an award for design, this is it. You'll be proud to have this phone in your home or office.



LED Display Shows No. Being Dialed.

Get It Far Below Market Place

We originally planned to sell this phone for \$169.95, and it would be a bargain at that price. When we decided to feature it in our catalog, we lowered the price to \$129.95.

Now we've been able to contract for enough of them that you can own an *Electronic Secretary-Phone* for only \$99.95! At that price, while we have them, you should order two.

Our absolute guarantee means you'll have a month to use this phone and see for yourself that our claims about it are true. Enjoy it!

WE ABSOLUTELY GUARANTEE!

Plug in the ELECTRONIC SECRETARY-PHONE. Use it for up to 30 days. If you decide for any reason you don't want to keep it, return it for a 100% refund.

• Handles TWO Phone Lines

Use the "Hold" button to switch back and forth. Or use them together for conference calls!

• Conference Call Feature

Just push both buttons and both lines are open. They're interactive, so you can tie two calls together!

• Speaker Phone

If you have a roomful of people, or if you just don't want to hold the instrument, your Speakerphone has wonderful sound fidelity plus volume adjustment!

• 32 Memories

Your phone "remembers" up to 32 numbers. Enter them just once, then dial by pushing one or two buttons. Even remembers long strings of numbers like MCI!

\$99.95 complete
SAVE \$20.00! Two for \$179.90
(+ \$2.50 per total order for shipping)

Order TOLL-FREE
For fast delivery on credit card orders
call toll-free 24 hours a day, 7 days a week:

800-443-0100

Ask for Ext. 111

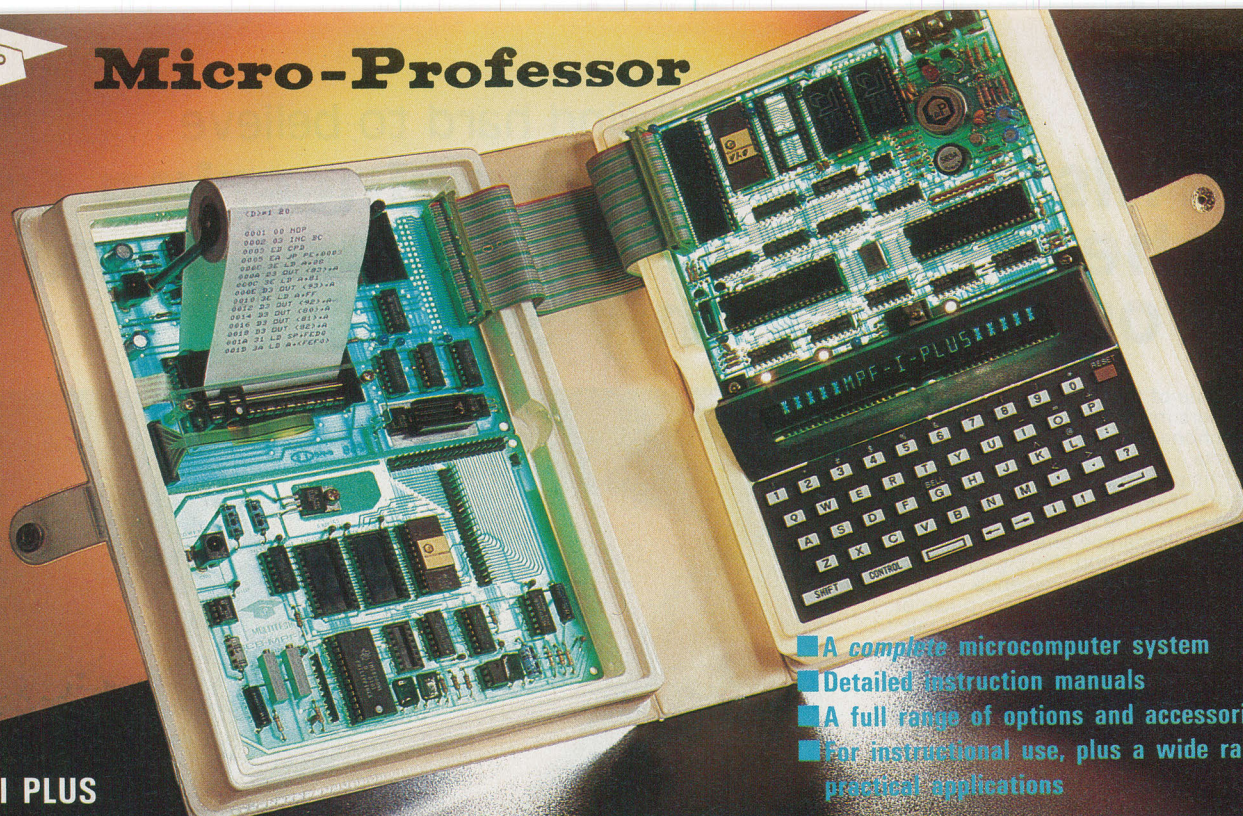
Or send check or money order.
Please add indicated shipping cost.

NEW HORIZONS

Dept. R11 5-31 50th Avenue
Long Island City, N.Y. 11101



Micro-Professor



MPF-I PLUS

- A complete microcomputer system
- Detailed instruction manuals
- A full range of options and accessories
- For instructional use, plus a wide range of practical applications

Learn Computing with the Micro-Professor-IP for \$199

The Micro-Professor (MPF-IP) is a complete hardware and software system that will expose you to the amazing world of microprocessors.

A comprehensive teaching manual gives you detailed schematics and extensive examples of program code. All of this makes for a superb learning tool for students, hobbyists and microprocessor enthusiasts alike. Also serves as an excellent teaching aid for instructors of electrical engineering and computer science.

With the Micro-Professor-IP you get:

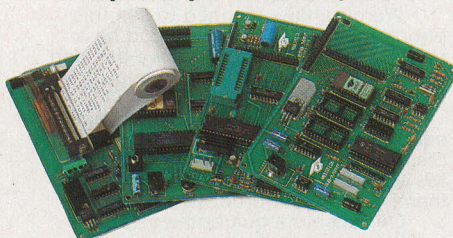
- Z-80 processor chip
- High quality 49-key keyboard
- On board 4 K-byte RAM
- On board 8 K-byte ROM including:
 - Interactive Monitor
 - Line Assembler
 - Two Pass Assembler
 - Tekt Editor
 - Disassembler
 - Language options of BASIC and FORTH.

You'll also get a lot more including:

- Built-in speaker
- 20 digit alphanumerical green tube display.
- 48 Input/Output lines
- Battery back-up circuits for RAM
- Bus expandable Z-80* architecture
- Three user's manuals
- Program storage/reading cassette interface

Options

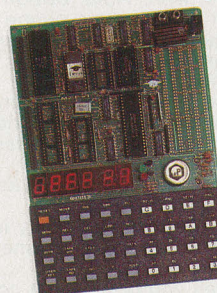
- Student Workbook(\$15)
- Printer (\$99)
- Speech Synthesizer Board (\$129)
- Sound Generation Board (\$99)
- EPROM Programming Board (\$169)
- Input/Output and Memory Board (\$99)



MPF-I Micro-Professor

Z-80* CPU, 2K RAM expandable to 4K, 2K RAM, sophisticated monitor expandable 8K, 6-digit LED display plus a built-in speaker, cassette interface, and sockets to accept optional

CTC/PIO, BUS is extendable. As well as being an exciting learning tool, the MPF-I is a great lowcost board for OEM's.



MULTITECH ELECTRONICS INC.
195 WEST EL CAMINO REAL SUNNYVALE, CA
94087 U.S.A. TEL: 408-7738400
TLX: 176004 MAC SUVL FAX: 408-7498032

*Z-80 is a trademark of Zilog Inc.

Distributor list U.S.A

Learning Labs, INC.

P.O. Box 122
Calhoun, GA 30701
TEL: 404-629-1521

SIVAD INC

P.O. Box 16664,
Jackson, MS39206
TEL: 601-355-3110

Technical Laboratory Systems, INC.

P.O. Box 218609
Houston, TX77218
TEL: 713-465-9793

L.A.B. Corporation

4416 River Road
Afton, MN 55001
TEL: 612-436-1169

Etronics

3928 148th N.E.
Redmond WA 98052
206-881-0857

DIGIAC CORP.

175 Engineers Road,
Smithtown, N.Y. 11787
TEL: (516) 273-8600

Canada

Future Electronics INC.

Montreal

237 Hymus Boulevard
Pointe Claire, Quebec
H9R 5C7
TEL: (514) 694-7710

OTTAWA

Boxter Centre
1050 Boxter Road,
Ottawa, Ontario K2C
3P2

TORONTO

4800 Dufferin Street
Downsview, Ontario
M3H 5S8

CALGARY

5809 Macleod Trail
South Unit 109 Calgary,
Alberta T2H 0J9

Vancouver

3070 Kingsway
Vancouver, B.C. V5R 5J7

Outside of North America mail to:

Multitech Industrial Corporation

977 Min Shen E. Road,
105 Taipei, Taiwan, R.O.C.
Tel: 02-769-1225 Tlx: 19162 MULTIC
23756 MULTIC



HI-FI Sound Converter For Your TV

GARY McCLELLAN

OVER THE PAST FEW YEARS SOME EXCITING things have happened to TV that have dramatically improved the medium. For example, cable/pay TV has brought quality movies and sports into the home, making your couch "the best seat in the house." Furthermore, television receivers themselves have been undergoing numerous improvements, and picture quality is noticeably better on some of the latest sets. Those improvements are making TV viewing better than ever, and are inducing people to watch TV more often.

Unfortunately, a TV set's sound system is usually its most overlooked area, and that is sad. With the exception of a few of the latest sets, the average TV has a four-inch speaker, a one-watt audio amplifier, and no tone controls. The result is sound quality that's good enough for the news, but that can't do justice to musical programs or feature movies. Combine that low-quality sound with a good picture, and you lose half of your potential viewing pleasure! But don't despair—now you can do something about it!

That's where our TV Sound Converter comes in. It's designed to correct the deficiencies of most TV sound-systems and to improve the sound quality to match that of the picture produced by the best sets. The project features a separate high-quality FM detector; treble and bass tone-controls; a loudness-compensated volume control, and an audio power-amplifier. Connect the TV Sound Con-

verter to a good speaker system, and you'll be amazed at how good TV sound can be!

There are no solder connections or modifications required at the TV receiver. That eliminates a potential shock hazard, and is sure to be appreciated by people who don't want to tear into their TV's. Other features of the converter include a sound input for your videocassette recorder (VCR), so you can improve the sound from that source, too. A muting circuit (which suppresses the between-station noise that you get when you change channels) is also included. And, on top of that, the converter can be used with any TV, whether it's a tube-, transistor-, or IC-type receiver.

The TV Sound Converter is moderately priced and easy to build. To keep the cost to a minimum, a special effort was made to use as many commonly available parts as possible. (Check the ads in **Radio-Electronics**.) Most of the circuitry—three IC's, two power transistors, and an assortment of inexpensive and readily available passive components—is contained on a hand-sized PC board. It cost us about \$45 to build, but that figure might be higher if you don't have a well-

stocked junkbox. Construction is straightforward and is pretty much limited to stuffing the printed-circuit board with parts, and to connecting the external controls, input jack, and power transformer to the board. One potential area of concern is the three coils used in this project. But don't worry about having to wind them; you can buy them prewound. The only coil winding that you'll have to do is to wind five turns of wire around one of the prewound coils. That's a job that anyone can handle, even someone who's never wound a coil before! So if you are concerned about ease of construction, don't worry—this project is not bad at all!

How it works

There are many ways to improve the sound quality of your TV receiver, and each has its advantages and disadvantages. Let's discuss some of the methods briefly, because it will help you to appreciate the circuitry used here. The cheapest and simplest way to improve the sound is to disconnect the set's internal speaker, and substitute a quality speaker-system. While the cost is low, the drawbacks include impedance-matching problems (many new sets use 32-45 ohm

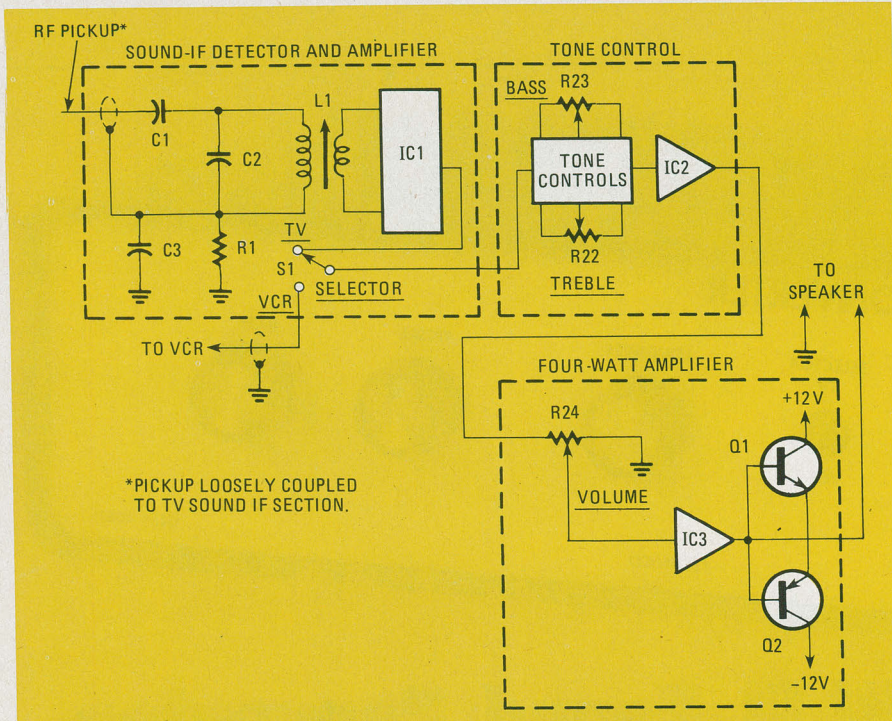


FIG. 1—SIMPLIFIED SCHEMATIC of the TV Sound Converter shows the three main blocks of circuitry: the sound-IF detector/amplifier, the tone-control section, and the audio power-amplifier.

speakers), excessive hum and distortion, and a severe shock hazard. You should know that power transformers have quietly disappeared from recent TV's, and that can make adding an external speaker a dangerous proposition. Another approach is simply to connect an external audio-amplifier across the TV's volume control. That costs more, and it requires modifications to your TV. It will eliminate the other problems mentioned earlier—except for the shock hazard. A serious drawback, however, is that many new TV's use a DC control-voltage to control the volume and, as a result, there is no audio signal at the volume control. That's why that approach is often ruled out.

That leads us to the TV Sound Converter, which uses a different (and better) approach. The device uses a complete sound-IF amplifier plus an audio amplifier to do the job. Careful design results in the best possible sound quality, and the elimination of the shock hazard. While cost might be considered a disadvantage to this method, the build-it-yourself nature of the converter keeps that under control.

The TV Sound Converter contains three "blocks" of circuitry. Figure 1 shows those blocks in a simplified schematic of the converter. The first block is a complete sound-IF amplifier and detector. Its circuitry is preceded by a special input-network made up of C1, C2, C3, L1, and R1. (Switch S1 bypasses this IF amplifier section for VCR inputs.) The combination of C2 and L1 is tuned to the TV-sound frequency (4.5 MHz) and rejects other frequencies that could interfere. The secondary winding of L1 is

an impedance-matching device. It provides the IC with the low impedance that it needs to see at its input. Capacitor C3 and resistor R1 are included to provide an RF ground for the input, and to minimize a shock hazard. That is important in case the input cable should somehow short itself to live TV-circuitry. The gain of the circuit is so high that simply placing the input cable near the TV-sound section will make it work. No electrical connections are required. In fact, with some TV's, the input cable can be placed on the outside of the rear cover with excellent results!

The second block is the tone-control section. That is nothing more than the usual treble and bass controls, plus an amplifier to make up for losses in that section. Finally, the third block is an four-watt power amplifier. Four watts is more enough power to drive a set of quality speakers to good volume with low distortion.

Now let's look at the circuitry in more detail, referring to the schematic in Fig. 2. The TV sound-IF signal is picked up by a "probe" that is loosely coupled to the sound-IF section of the TV. The signal is fed to the IF IN terminals of the converter. Capacitor C2 and coil L1 are resonant at 4.5 MHz, providing selectivity for the IF amplifier. The IF signal is transformer-coupled into the IF amplifier via pin 1 of IC1. It is amplified by a factor of about 80 dB, and appears at pin 8 of the IC. Coil L2 reduces the signal level to about 150 millivolts, which is necessary for proper muting-circuit operation. The 150-millivolt signal appears at pin 9 of IC1 and goes to two places.

First, it drives a quadrature-type de-

detector contained inside the IC. That works in conjunction with C9, L3, and R3 to produce a demodulated audio signal. That signal goes to an internal amplifier, and ultimately to pin 6, the output of IC1.

At the same time, the signal from pin 9 drives an internal level-detector circuit that generates the muting function. The output of the level detector appears at pin 12 of IC1. The output is divided by R4, R5, and R6, and filtered by C12. Potentiometer R5 sets the muting threshold. The voltage applied to pin 5 of IC1 controls an amplifier inside the IC that switches audio to pin 6 when there is a signal of sufficient strength present. Finally, the detected audio appears at pin 6 of IC1. A simple de-emphasis network made up of C13 and R7 restores its proper-high frequency response. The audio appears at the AF OUT terminals and goes to a switch, S1, that determines whether the rest of the circuit (the tone-control and amplifier blocks) will act on that audio or the audio from your VCR.

The tone-control section consists of a standard bass and treble network and an amplifier. Audio coming from S1 (the signal source) is applied to the AF IN terminals. A simple bass-control circuit made up of C15, C16, R9, R10, and R23 boosts or cuts the bass frequencies. The treble frequencies are handled by a simple boost/cut circuit made up of C17, C18, and R22. Resistor R11 is included to minimize interaction between the bass and treble controls. The signal output from the tone controls is taken from the slider of the TREBLE potentiometer, and drives op-amp IC2. That device is a simple non-inverting amplifier with a gain of 50—enough to overcome the losses that take place in the tone-control circuitry. The amplified signal from IC2 drives an external volume control, which features loudness compensation (bass frequencies are boosted and the treble reduced slightly at low volume-levels) to improve the audio quality. The loudness compensation-circuit is made up of C29 and R25, which are connected to a tap on the volume control.

From that point, the audio signal goes to IC3, an LM377 two-watt audio amplifier IC. That's a rather unusual application for that IC, which is intended for lower-power applications. The circuit was abstracted from the 1980 edition of the National Semiconductor *Audio Handbook*. The output of the IC drives the speaker through R20. At low levels (below about 100 mW) the IC provides all power. But as the output rises, the voltage drop across R20 also rises, and that causes transistors Q1 and Q2 to turn on. They act as emitter followers and boost the power level. As a result, it is possible to get more than four watts of power from a two-watt IC. The technique is simple, low cost, and effective. Resistors R17 and R18 set the gain of the circuit, while

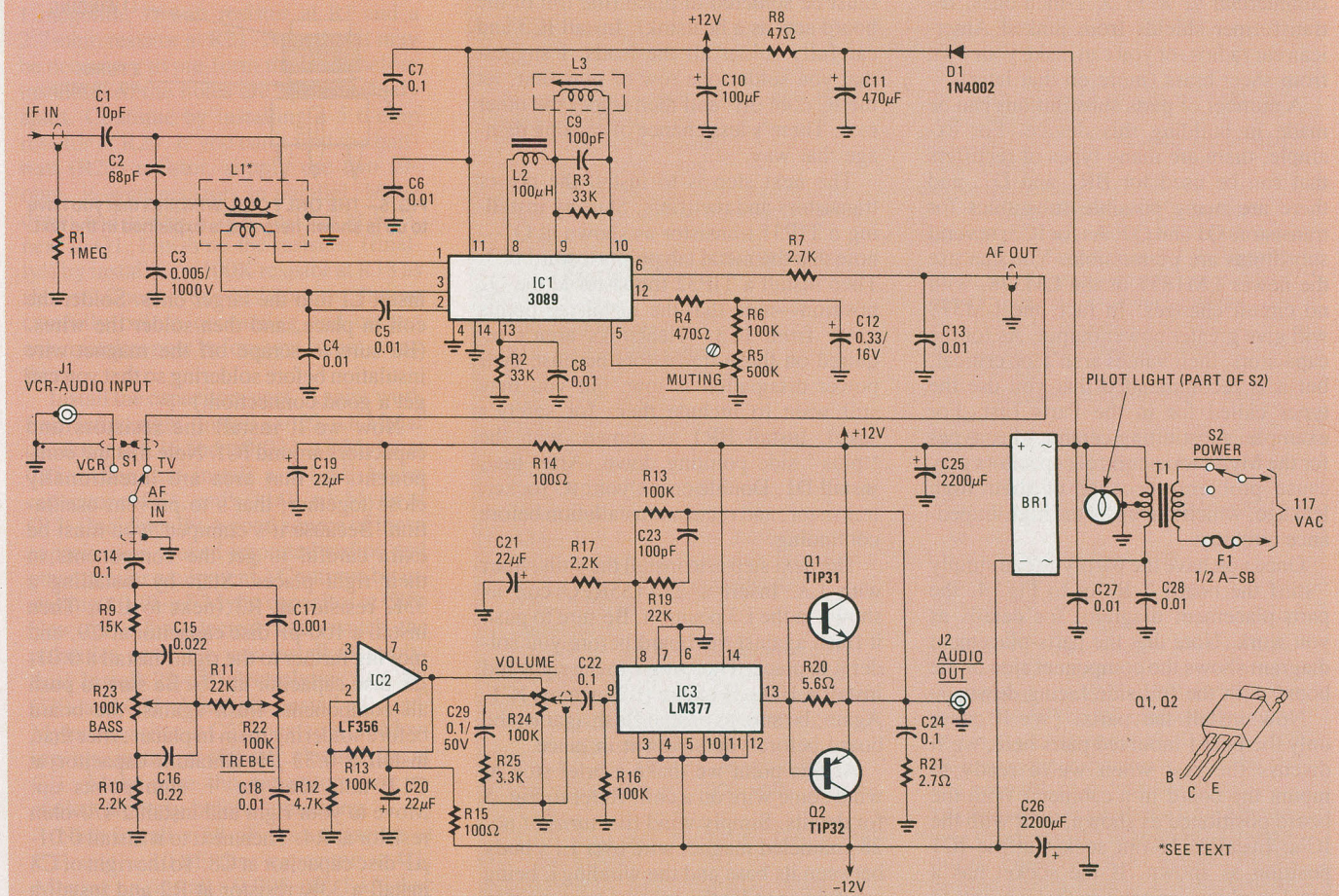


FIG. 2—THE PILOT LIGHT SHOWN is optional. It was part of the power switch (S2) used by the author. Note that R18 (connected between C23 and R19) is incorrectly labelled R13.

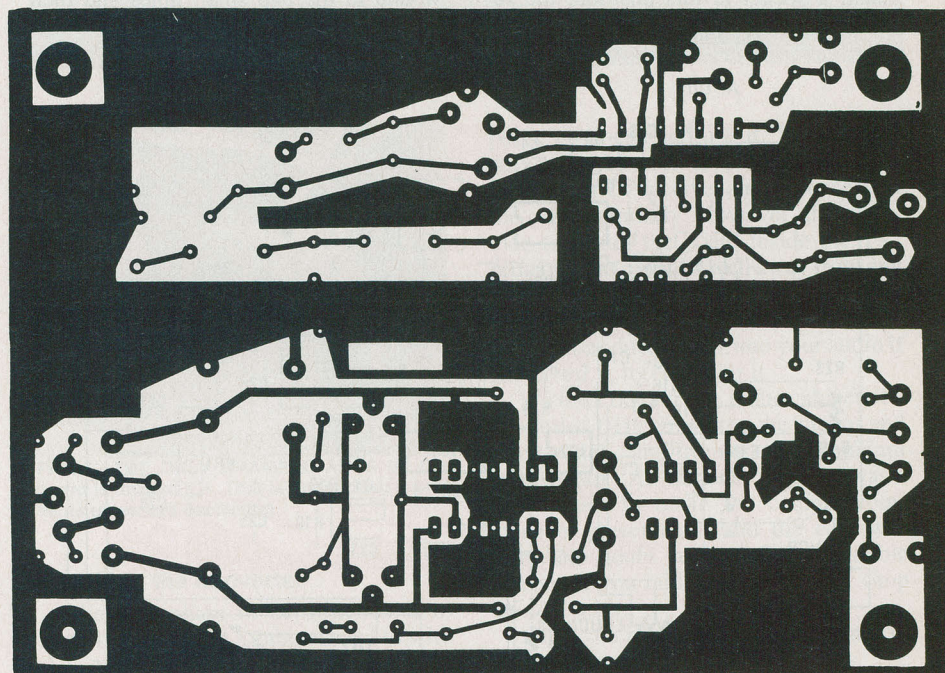
C21, C23, and R19 shape the frequency response.

All that's left are the power supplies (+12 and -12 volts). The amplifier section uses a conventional ± 12 -volt supply, made up of T1, BR1, C25, and C26. The IF section has its own 12-volt power supply: D1, C11, C10, and R8. A separate supply is needed for that section because it was found that powering it from the same supply used by the amplifier generated noticeable hum.

Construction

The first step in building the TV Sound Converter is to obtain or make a PC board. You can make your own board—the full-size foil pattern is shown in Fig. 3. A pre-etched and drilled board is available (from the supplier indicated in the Parts List). Whichever you choose, you should note that, because of the high sensitivity of the IF amplifier, a PC board is a necessity for this project. If you try to breadboard the device, the chances are that it will oscillate and do other strange things. Play it safe and use a PC board!

Once you have a board, the next step is to obtain the parts. Generally, they should be available from many sources. As for the Miller coils, they should be available from larger parts-distributors. Shields are required for those coils—you can use



4-7/8 INCHES

FIG. 3—YOU MUST USE A PC board for the converter. If you don't, the chances are that the circuit will oscillate.

commercial $\frac{1}{2} \times \frac{1}{2} \times 1$ -inch ones, IF-transformer shields from junked American car radios, or you can make your own from sheet brass (more on that later).

A number of parts substitutions can be made in building this device. For example, there are many types of rectifiers that can be used for BR1 and D1, and there are many possible substitutes for transistors Q1 and Q2. As for IC3, several substitutes are permissible: You can use the newer LM1877 or the LM378, with no circuit changes. In fact, the LM378 will give greater power output. As for the capacitors, their values aren't too critical, but it is recommended that you use the types called for in the Parts List. For example, substituting ceramic-disc types for the Mylar tone-control capacitors may cause problems because of their high leakage, which can upset the high-impedance circuitry.

Once you have the parts you can simply "stuff the board." Refer to Fig. 4, the parts-placement diagram, for details as you work. Note that the parts-placement diagram shows the component side of the board with the foil side facing down.

Now install the parts. (We'll cover only the board-mounted parts here; we'll discuss the rest when we're ready to mount the board in a cabinet.) With the board positioned as shown, start with the IC's: Install a 16-pin socket at the IC1 position as shown. If the socket has a pin-1 marking, orient it so that it points to your right. Then go to the IC2 position and install an 8-pin socket. Be sure to orient any pin-1 marking as shown. Do not install either IC1 or IC2 until you are told to do so. Move on to IC3. *Do not* install a socket at this position; the IC

must be soldered in place (the foil of the board acts as a heatsink). Install IC3 and carefully solder all the leads. I suggest that you solder one row of pins first, let the IC cool off, and then solder the other row. There's less chance of causing damage that way.

The next step is to install the power transistors and rectifiers. Start by installing a TIP31 transistor as shown at Q1—note that the metal tab points toward IC3. Then install a TIP32 transistor at the Q2 position—note that the metal tab points away from IC3. (Heatsinks aren't required on those transistors because their power dissipation is low, but you may still want to include them for safety's sake). Install BR1 as shown, with the "plus" side pointing down. After that, install D1. Double check your IC socket, transistor, and rectifier installation before continuing.

The next step is to install the coils. Start with L3. Insert a 23A155RPC coil as shown in the L3 position. Be sure to push it flush against the board before you solder it in place. Then move to the right and install a 100 μ H choke (L2) against IC1. Again, be sure to push it flush against the board before you solder it in place.

At this point we make a brief stop to wind some wire on a coil. Refer to Fig. 5 for details. Simply wind five turns of no. 28 enameled magnet wire over L1's body between its base and the windings, being careful not to let the magnet wire overlap the existing winding. Then twist the free ends of the new winding once to hold them in place. Now refer back to Fig. 4. You are going to install the coil at the L1 position. Insert the wires of the coil you wound in the two small holes and then

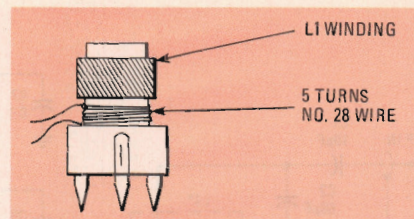


FIG. 5—THE ONLY COIL WINDING that you have to do is shown here and is explained in the text.

insert L1 into the larger ones. Solder the coil in place, and then solder the wires. (Be sure to scrape off the magnet-wire insulation before soldering so that you can get a good connection.)

Now we'll install the resistors and capacitors around IC1. Note that the components in that area are intentionally close together; that's to prevent oscillation. Because it's cramped, you must be extra careful to get the components in their right places. Start by installing a 33K resistor at R3 (next to L3). Then install a 100-pF disc capacitor at C9, and moving farther to the right, install a 0.01- μ F disc capacitor at C6. Be sure to push all components flush against the board before soldering them in place. After that, install a 0.33- μ F tantalum capacitor at C12; note that the + sign points up. Move to your right and install a 470-ohm resistor at R4. Then next to it install 0.01- μ F disc capacitor at C8. To the right of C8 install a 33K resistor at R2 and install a 0.1- μ F disc capacitor at C7. Finish up work in this area by installing a wire jumper at "J." A piece of leftover resistor-lead will work fine. Now, stop and examine your work, and correct any mistakes you may find before going on.

Continuing with the IC1 components, install a 0.01- μ F disc capacitor at C13 and a 2.7K resistor at R7. Next to it, at R5, install a 500,000-ohm trimmer potentiometer. Move to the right and install 0.01- μ F disc capacitors at C4 and C5. Finish up the circuitry around IC1 by installing a 100,000-ohm resistor at R6 as shown. Note that R6 is installed about an inch over the top of the IC. Place short lengths of insulated tubing over the leads and then install them in the places shown. That takes care of IC1; on to the less-critical circuitry!

The remaining resistors are installed next, starting at the left-hand side of the board and working toward the right. Begin by installing a 2.2K resistor at R10 and a 22K resistor below it at R11. Move down a bit and install a 15K resistor at R9 and then jump over to IC2 and install a 4,700 ohm resistor at R12, and a 100K resistor at R13. After that, install a 100-ohm resistor at R15, above IC3. On the other side of IC3 install a 100K resistor at R16 and, next to it, install a 100-ohm resistor at R14. After that, install a 2.2K resistor at R17. Move up to the center of the board and install a 47-ohm resistor at R8. Move up still farther and install a

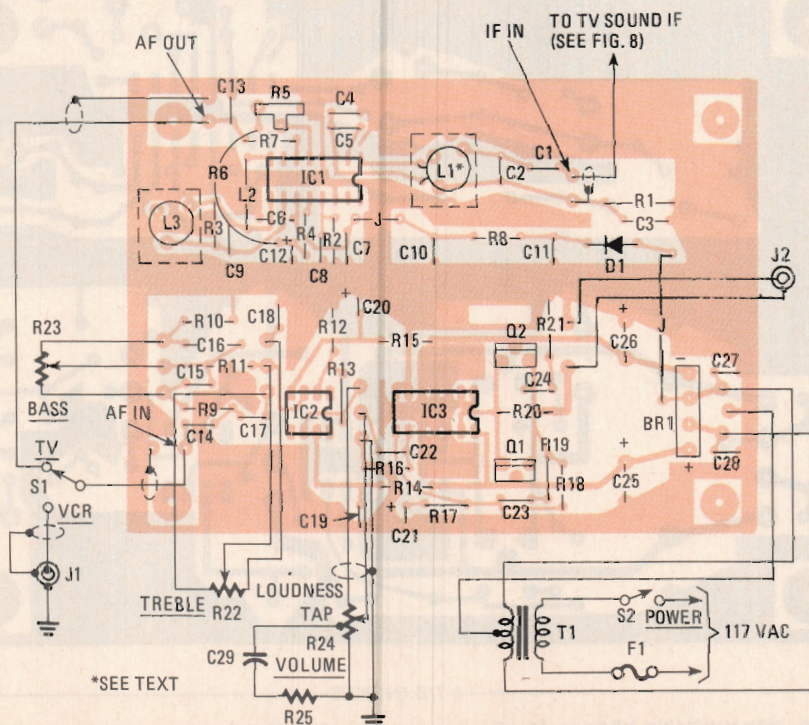


FIG. 4—PARTS-PLACEMENT DIAGRAM. Both on-board and off-board connections are shown.

1 megohm, 1/2-watt resistor at R1 and a 2.7-ohm resistor at R21. Note that it may be necessary to pre-form the leads before installation; the holes are spaced widely apart. Continue by installing a 5.6-ohm resistor at R20. If you can't find the half-watt (R20) resistor, simply use two 10-ohm, 1/4-watt resistors in parallel. Move down and install a 22K resistor at R19, next to Q1. Finish up the resistors (finally!) by installing a 100K resistor at R18 as shown. Check your resistor installation carefully before continuing and correct any mistakes now before you forget about them.

Install the capacitors next. Again, work from left to right. Install a 0.22-μF Mylar capacitor at C16 and a 0.022-μF Mylar at C15. After that install a 0.1-μF Mylar capacitor at C14, and a 0.001-μF Mylar at C17. (Incidentally, a good source of those capacitors is junked imported radios and other similar equipment.) Continue by installing a 0.01-μF Mylar capacitor at C18. Now for a few electrolytics—watch the polarities any time you install electrolytics! Install 22-μF electrolytics at C19, C20, and C21. After that, install a 0.1-μF Mylar capacitor at C22, next to IC3. Moving up, install a 100-μF electrolytic at C11. Make sure the capacitors are installed properly before continuing.

Now install a 68-pF disc capacitor at C2, and a 10-pF disc capacitor at C1. Moving on, install a 0.005-μF, 1-kV disc capacitor at C3. After that, install 2200-μF capacitors at C26 and C25. Make sure those capacitors are installed properly before continuing. Then install a 0.1-μF Mylar capacitor at C24 and a 100-pF disc at C23 (at the lower edge of the board.) Finish up the capacitor installation with 0.01-μF discs at C27 and C28, next to BR1. Check your work and correct any errors before you continue.

All that's left to do on the board is to install a jumper and the coil shields. The jumper comes first. Cut a 2-inch piece of insulated hookup wire, strip the ends, and connect it at the holes near BR1 and D1.

Before you install the coil shields, wrap pieces of plastic electrical tape over the terminals of L1 and L3. That helps to prevent shorts. Then snap the coil shields into place and solder them to the board.

If you don't have access to commercial shields, or to a junked American-made car radio for the shields from its IF transformers, you can make them yourself. Here's how: Cut a strip of sheet brass (available from hobby shops) into two 1 3/4 × 1-inch pieces. Then roll each strip into two 1/2-inch (diameter) by 1-inch (high) cylinders. Solder the edges to keep the metal in place. Then solder pieces of solid wire to the edges of the cylinders. Those are the mounting terminals. Insert your new coil shields into the board and solder them in place. That completes the construction of the board. And if you're done things correctly, the completed board should look like that shown in Fig. 6.

PARTS LIST

All resistors 1/4-watt, 5% unless otherwise specified

R1—1 megohm, 1/2 watt
R2, R3—33,000 ohms
R4—470 ohms
R5—500,000 ohms, trimmer potentiometer
R6, R13, R16, R18—100,000 ohms
R7—2700 ohms
R8—47 ohms
R9—15,000 ohms
R10, R17—2200 ohms
R11, R19—22,000 ohms
R12—4700 ohms
R14, R15—100 ohms
R20—5.6 ohms, 1/2 watt (see text)
R21—2.7 ohms
R22, R23—100,000 ohms, potentiometer, audio-taper
R24—100,000 ohms, potentiometer, audio-taper with loudness tap (Radio Shack 271-1723 or equivalent)
R25—3300 ohms

Capacitors

C1—10 pF, 1000 volts, ceramic disc
C2—68 pF, 1000 volts, ceramic disc
C3—0.005 μF, 1000 volts, ceramic disc
C4, C5, C6, C8, C13, C27, C28—0.01 μF, 50 volts, ceramic disc
C7—0.1 μF, 16 volts, ceramic disc
C9, C23—100 pF, 1000 volts, ceramic disc
C10—100 μF, 16 volts, radial-lead electrolytic
C11—470 μF, 16 volts, radial-lead electrolytic
C12—0.33 μF, 16 volt, tantalum
C14, C22, C24, C29—0.1 μF, 50 volts, Mylar
C15—0.22 μF, 50 volts, Mylar
C16—0.22 μF, 50 volts, Mylar
C17—0.001 μF, 50 volts, Mylar
C18—0.01 μF, 50 volts, Mylar

C19, C20, C21—22 μF, 16 volts, radial-lead electrolytic
C25, C26—2200 μF, 16 volts, radial-lead electrolytic

Semiconductors

IC1—LM3089 FM receiver IF system
IC2—LF356N monolithic JFET op-amp or TL081 general purpose BIFET op-amp
IC3—LM377 dual 2 watt audio amplifier or LM1877 dual audio-power amplifier
Q1—TIP31 NPN power transistor
Q2—TIP32 PNP power transistor
D1—1N4002
BR1—full-wave bridge rectifier, 1 amp, 50 volts
T1—18 volts, 2 amps, center tapped
L1, L3—10–19 μH adjustable coils, J.W. Miller 23A155RPC
L2—100 μH RF choke, J.W. Miller 9210-76
F1—1/2 amp slow-blow fuse
J1—RCA phono jack
J2—Two-contact connector
S1—SPST toggle switch
S2—SPST power switch (with optional 16-volt pilot lamp)

Miscellaneous: 5 feet RG-174 coaxial cable, 6 inches no. 28 enameled wire, one 16-pin IC socket, one 8-pin IC socket, coil shields, cabinet, hardware, 3 knobs, AC line cord with plug, fuse holder, etc.

The following is available from Menda-kota Products, PO BOX 20 HC, Orange-hurst, Fullerton, CA. 92633: AUD-1 printed-circuit board, \$12.00. California residents add 6% sales tax. Non-USA residents include an additional \$3.50 for first-class postage and handling. Coils L1-L3 can be ordered from: Circuit Specialists, Box 3047, Scottsdale, AZ 85257. Price is \$7.95 postpaid; please specify J.W. Miller part numbers when ordering; Arizona residents add 4% sales tax.

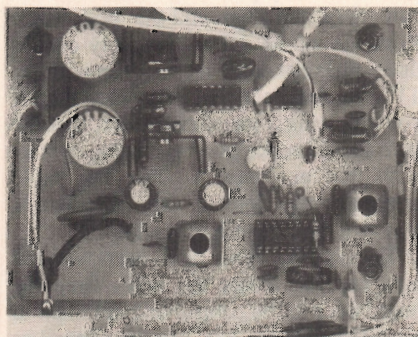


FIG. 6—THE ONLY CRAMPED AREA on the board is around IC1. That is intentional; it prevents unwanted oscillation.

Installing the converter

The next phase of construction is to install the board in a cabinet, and to wire the controls and power transformer to it. Let's start by discussing the cabinet. The converter is designed to be installed in almost any type of cabinet, plastic or metal. So, if you have a particular type of cabinet in mind, and there is room for the

parts, go ahead and use it. In fact, you may even be able to mount the board inside your TV receiver and dispense with the cabinet entirely! However, if you decide to install the board inside the TV, remember to mount it well away from any heat-producing circuitry, and away from the TV's horizontal-output stage. The latter can introduce a buzz into your audio if the board is too close to it.

We built our version in the cabinet of a discarded UHF converter; the chassis and front panel came from an old aluminum chassis-box. All that was required was a little work to make the cabinet components presentable, and the cost was zero. No doubt you can find a suitable cabinet if you raid your junkbox or shop around a bit.

Once you have a cabinet, you can drill all the mounting holes for the parts. The photograph shown in Fig. 7 should give you an idea of where to place them. The board itself is mounted on the bottom of the cabinet using 1/4-inch spacers. Drill the holes, clean up the cabinet, and paint

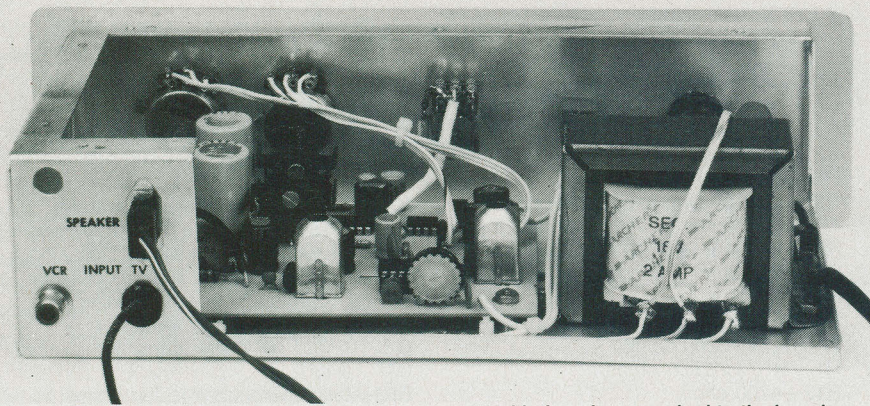


FIG. 7—THE OFF-BOARD components should be mounted before they are wired to the board.

it if necessary. Label the controls with the press-on letters that are available from many electronics supply houses and art-supply stores. Then install the controls, connectors, and the power transformer. By this time you are ready for the final wiring.

All that is left to do is to connect the cabinet-mounted components to the board. Refer again to Fig. 4, the parts-placement diagram, for details. Start by stripping both ends of a 3-foot piece of RG-174 coax cable as shown in Fig. 8. Separate the shield braid on one end and twist it to form a separate lead. That end will be connected to the board shortly. As for the other end, strip off 1 inch of the insulation, but leave the center conductor untouched. Then cut the shield braid all of the way back to the insulation. Place a piece of 1/4-inch heat-shrink tubing over the cable, positioning it so that it overlaps both the end of the center conductor and the braid, and then shrink it in place. That end of the cable is the RF pickup for the converter. It will be placed near the sound-IF section of your TV. Refer to Fig. 4 for the remaining connections. Connect the other end of the RG-174 cable to the IF pads on the board. Note that the shield goes to the pad that connects to C3/R1.

Now for some other shielded-cable connections. Conventional microphone cable can be used for those. Cut two short lengths (about 6 inches), and strip one end of each cable. Install one cable at the AF OUT (the output of the sound-IF detectors) connections, and the other at the AF IN pads. Cut another short length (about 6 inches) of dual-conductor shielded cable for the volume control. Note that if you

don't have such cable, two pieces of regular, single-conductor shielded cable will do fine. Strip one end and connect it to the VOLUME pads as shown. That takes care of the shielded-cable connections.

The remaining connections can be made with conventional hookup-wire or ribbon cable. We used ribbon cable for a neater appearance. Start with the bass and treble controls. Cut short lengths of wire and install them as shown. If you used hookup wire, twist the bass-control wires together, and the treble-control wires together, so that they won't be confused. Then continue with the speaker leads. Cut two short lengths of wire, and install them as shown. Finally, cut three short lengths of wire for the power transformer, and install them as indicated in Fig. 4. That takes care of the board cable connections. Install the board in your cabinet and get ready to complete the wiring.

We still have to wire the POWER switch, S1. Route the cables to the switch, cut them to size, and connect them to the switch. Then connect J1. The shell of that jack is the only part of the converter circuit connected to ground that goes to the "outside world." Be absolutely certain that it does not come into contact with the TV set's chassis! (That also means that, if you are using a metal enclosure, that the jack should make good electrical contact with that enclosure.) Make the cable ground connections exactly as shown—that will minimize hum pickup.

The controls come next. Start with the bass control. Route the wires from the board over to the control and cut them to size. Connect the wires to the control as indicated. After that, connect the treble control in the same manner. The volume

control (with the loudness tap) comes next. But first, install the loudness components. Connect a 33K resistor in series with an 0.1 μ F capacitor and wire them to the volume control as shown in Fig. 4. Route the volume cable over to the control, cut it to size, and connect as has been indicated.

The next step is to connect the speaker wires. When routing them to J2, be sure to position them well away from the bass and treble cables. After that, connect the power transformer. Connect the wires to T1 as shown, after routing them well away from all other wires. If your power switch has a built-in pilot light, connect it now; otherwise disregard that step. Finally, wire up F1 and S2. With that you have finished assembly, except for installing IC1 and IC2. You can do that after you have applied power to the board and verified that the proper supply-voltages are present at the IC sockets—+12 volts at pin 11 of IC1, and pin 7 of IC2, and -12 volts at pin 4 of IC2. (There should also be +12 volts at pin 14 of IC3 and -12 volts at pins 3-5 and pins 10-12 of IC3.)

Adjustments

One of the nice features of this device is that, although adjustments are required, no test equipment is necessary to make them. All you need is a TV receiver in good condition, and a plastic hex alignment-tool.

Start by presetting the adjustable components and checking the operation of the unit. Set the slugs of L1 and L3 to mid position. Then turn potentiometer R5 fully clockwise. Connect a speaker, and apply power to the board. Set S1 to its VCR position, and connect a tuner or other high-output-level device to J1. At this point, the project should perform like any other high quality audio amplifier. If not, check your wiring, and correct any errors. Set S1 to the TV position. You should hear a roar of noise. If not, turn the potentiometer in the other direction. If you then hear the roar, you've wired the control backwards. Reverse the wiring (if necessary) and you are ready to try the converter with your TV.

Modern TV's can pose a serious shock hazard when operated with the back cover removed. Do not touch any components while the set is plugged in.

Remove the rear cover of your TV, and locate the sound section. Often that circuitry will be identified by a module or tube placement, or by a sticker inside the set. Once you have found the sound section, connect the power to the set and turn it on. Tune in a strong station and adjust the fine tuning for the best sound quality. Place the RG-174 cable from the converter near the sound-IF tube, transistor, or sound-detector IC. With some IC-type sets you can jam the pickup lead directly into the sound coil for a strong signal. You should now hear weak sound or per-

continued on page 100

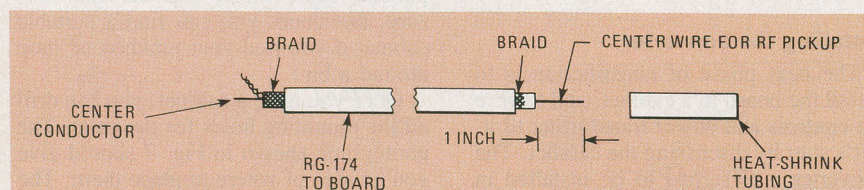


FIG. 8—THE RF-PICKUP cable. The shield should be twisted to form a lead at the board end. It should be cut off at the other end, and the center conductor and a bit of the braid and outer insulation covered with heat-shrink tubing.

INNOVATIONS IN ELECTRONICS

Gee-whiz products from tomorrow that you can buy today—all possible thanks to the wonders of modern electronics

WARREN ROY

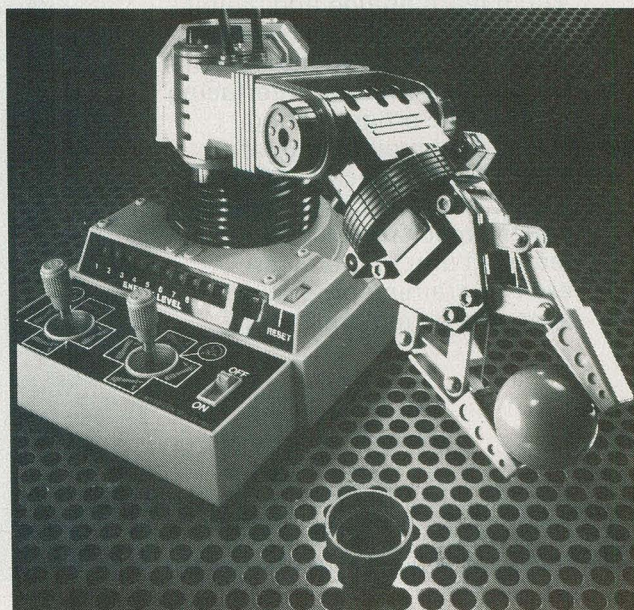
ELECTRONICS! THE WONDERFUL WORLD OF ELECTRONICS! IT seems to be behind every new product to brighten our life. Some of these products are truly significant. Others are conveniences, and still another group are just fun. But all are exciting to those of us in the know; those who can understand and appreciate what the product really does, how it does it, and why that makes it innovative.

As we have all seen, the price tag of a new automobile has moved from \$2,000 to \$10,000. In the same period of time the price of a small computer has dropped from several thousands of dollars to less than \$800 for a complete system with plenty of memory and a disk drive. That is the kind of movement electronics has made possible, and the kind of excitement that electronics generates in all of our lives. In a time of rising prices, the features of modern electronics continues to drop and only technological development has made that possible.

The idea behind this article comes from the dozens of electronics catalogs filling our mailboxes—each one crammed with the latest examples of products delivered thanks to electronic technology. The editors of **Radio-Electronics** asked me to look through those pages, select examples of the technology and present a variety of selections for you, our readers. That's what any author would consider a fun assignment—pick what you like and write about it. And so I have. You may not agree with my choices or with my reasons behind my selections. I may have overlooked a significant item. I picked the items I liked—that doesn't mean that they are the best selling, or the most innovative. It does mean that when I looked, these were the items that stood out. OK. Now you know the rules. Let's find out if my idea of electronics innovations—1984, is the same as yours.

Robots, ROBOTS, robots

If you've ever wanted to know what it felt like to control the robot arm that inserts and removes radioactive fuel rods into and out of the core of a nuclear reactor, here's an easy way to find out. A Japanese firm, called Armatron, has devised a working replica of an industrial robot arm. It's designed to work just like the ones used in ultra-modern factories and laboratories. Quoting right from the *Sharper Image* catalog offering this device gives a bit



THIS WORKING REPLICA of an industrial-robot arm is manufactured by Armatron, a Japanese firm. It is available in this country from sharper image.

NTS Electronics

Learn Robotics, Microcomputers, Microprocessors, Digital Video, Test Equipment and more with NTS INTRONIC™ home training. Courses include state-of-the-art equipment, lessons and texts to make your hands-on programs exciting and down-to-earth practical.

HERO 1 is included in two courses, one basic and one advanced. You'll cover principles of industrial electronics, microprocessor troubleshooting, fundamentals of mechanics, and robotic applications in industry. You'll learn analog and digital skills, radio control, fluidic, pneumatic and servo-mechanisms, as well as computer interfacing and robotic programming. **HERO 1**, complete with arm, gripper and speech synthesis board, is a fully self-contained electro-mechanical robot—the featured unit in the most exciting training programs ever offered in home study.

NTS Intronic Training is a carefully developed and tested learning system providing a thorough intergration of advanced electronic hardware with modern lesson texts. The relationship between theory and practical applications is made clear through the hands-on experience of building and assembling kits of state-of-the-art equipment. Courses include a wide variety of test instruments, both digital and analog, as well as other units not shown here. And, depending on the NTS program you select, you can earn up to 30 CEU credits for successful completion. Our full-color catalog has complete details. NTS has taught industrial skills for over 78 years—a record that has no equal.



Training.....

FIRST WITH TOMORROW'S TECHNOLOGY

1. Advanced "Z Chassis" NTS/HEATH "Smart Set"

with computer space command remote control and space phone. Originate or receive telephone calls through this set and the number appears on the screen-store your police and other emergency numbers into memory which may be recalled and auto-dialed at any time. Traditional and incomparable picture quality. Unit has Quartz Controlled Tuning, 178 channel capacity, remote antenna switch accessory for reception of VCR, VDR, Broadcast, Cable, Video Games, and Personal Computer Input (no cable change) plus computer-controlled color. Featured in all-new Video Technology Course.

2. NTS/HEATH HN89A Microcomputer

is included in two programs. This famous and reliable unit features Floppy Disc Drive, 48K Memory on Board, CRT Terminal with its own Z-80 Processor, and standard keyboard as well as Numerical Input Keyboard. The growing importance of computer knowledge and skills have made these programs increasingly significant. The experience gained in assembling these kits is invaluable in the understanding of computer troubleshooting skills.

3. **NTS Microprocessor Trainer** is included in our Industrial and Microprocessor Technology Course. It is a portable unit, contained in a convenient high-impact carrying case. Hardware/Firmware includes Monitor Operating System-Expandable User Memory-User Experimental On-Board Section-Breakpoint Editor-Single Step Trace-Cassette I/O.

NO OBLIGATION

NO SALESMAN WILL CALL



TECHNICAL TRADE TRAINING SINCE 1905
Resident and Home-Study Schools
4000 So. Figueroa St., Los Angeles, CA 90037



Use the mail-in card or fill out and mail the coupon. Indicate the field of your choice. (One, only please.) FREE full color catalog will be sent to you by return mail.

NATIONAL TECHNICAL SCHOOLS Dept. 206-113
4000 South Figueroa Street, Los Angeles, CA 90037

Please send FREE color catalog on course checked below:

- | | |
|---|---|
| <input type="checkbox"/> Robotics | <input type="checkbox"/> Computer Electronics |
| <input type="checkbox"/> Digital Electronics | <input type="checkbox"/> Video Technology |
| <input type="checkbox"/> Auto Mechanics | <input type="checkbox"/> Home Appliances |
| <input type="checkbox"/> Air Conditioning/Solar Heating | |

Name _____ Age _____

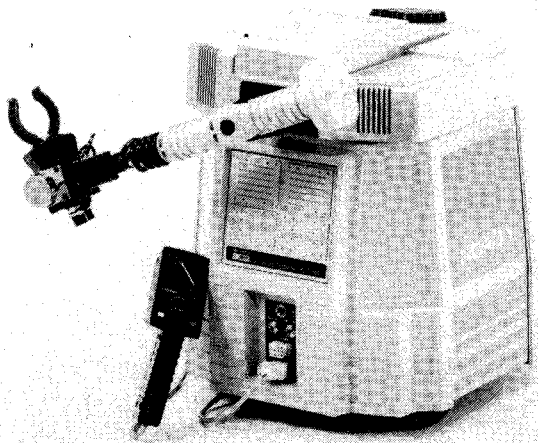
Address _____

Apt. _____ City _____

State _____ Zip _____

☐ Check if interested in G.I. information.

☐ Check if interested ONLY in classroom training in Los Angeles



THE SOPHISTICATED HERO ROBOT from Heath is available both in kit form and fully assembled.

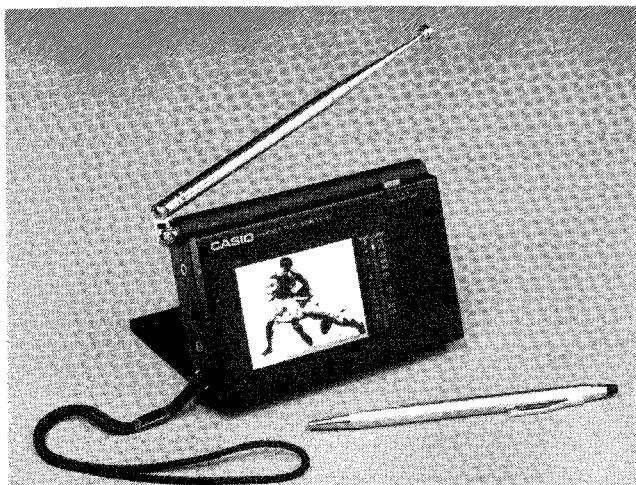
more information on what it will do. "Drop an olive in your martini, play a game of robot chess, pass hors d'oeuvres to startled party guests." The unit comes with a variety of accessories that let you practice and polish your skills. It's made of high-impact plastic, weighs 2½ pounds and measures 6×9×8 inches. The arm assembly is 15½ inches long and the non-slip gripper jaws open to 2 inches.

At a more sophisticated level is *Hero*, the now-famous robot produced by the Heath company as both a kit and an assembled ready-to-go-to-work robot. *Hero* is a complete, mobile, machine with its own on-board computer, a voice, and lots of other goodies. I'm in the process of assembling a *Hero* of my own and that's become a challenge in itself. About 15 more hours of work and I'll be ready to switch it on and start enjoying the jobs I have scheduled for it.

By the way, robots aren't new to regular readers of **Radio-Electronics**; we showed you how you could build your own, in a series of articles that started in the August 1980 issue.

Television—always something new

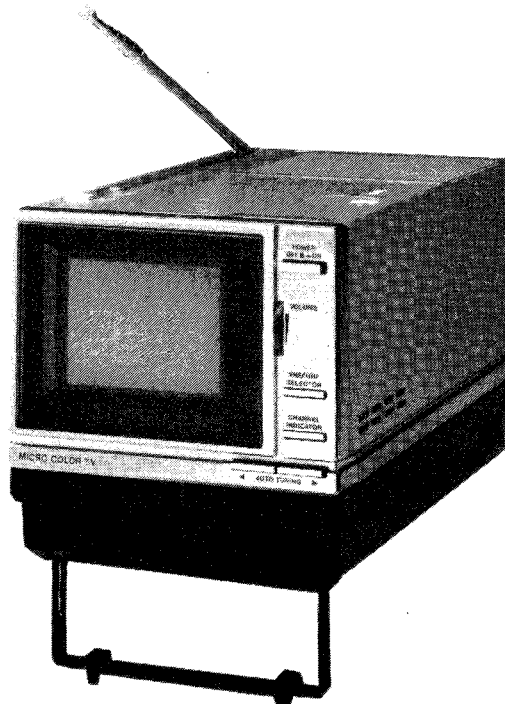
Radio-Electronics first told you about a portable flat-screen TV more than two years ago. It was a cover story on the October 1981 issue. It was the announcement, at that time, that Sincalir had shown a flat-screen TV receiver. And today, if you have \$300 to spare, you can buy one for yourself. It's the Casio large-screen (large for a portable set) liquid-crystal display, flat, pocket-size



POCKET TELEVISION. This tiny unit from Casio measures 4 × 5 × 1 inches and features a 2¾-inch LCD "screen."

TV. The LCD screen delivers a great picture on the 2¾-inch screen and the entire set measures a miniature 4 × 5 inches and is just about 1 inch thick. All the features you might expect are built right in, a high-performance VHF-UHF tuner, a speaker, of course, and a 4-way power system that guarantees complete portability. Also, an external antenna terminal is included for use when it's convenient for you to stay in one place. As it says in the *Markline* catalog listing this set "It's the TV of the future for people who need information and entertainment to go!"

OK, you want a portable set; but you want color, too. Then your choice in TV receivers might be the Panasonic CT-3311 Micro Color TV. It measures a mere 2.6 inches diagonally, weighs only 3.3 pounds and cost a few pennies under \$500.



THIS SMALL COLOR PORTABLE from Panasonic has no channel selector dial. Instead, it features an electronic auto-search tuner.

There's no tuning dial to turn either, thanks to the electronic magic of Auto-Search. At the press of a button, the electronic tuner searches for the channel you want—UHF or VHF—finds it, and locks it in. The receiver is also handy as a portable monitor for your video camera.

I know you've already heard of Seiko's wristwatch TV and I have deliberately not included it here. Since you can't go out and buy one today it doesn't fit into the scope of this article. But how about being able to turn on your TV by pushing a button on your digital wristwatch? No! we're not kidding. That product is available right now for only \$69.95. Of course, since what pushing that watch button does is to active a remote module, you can also control any electrically-powered device up to 300 watts. And since there are two channels you can control two different devices in the same room. It's an infra-red remote control, so the signals are kept within the one room and as a result you can have additional "watch-controlled" devices all over your home.

Talking about watches

The modern digital watch is an amazing phenomenon. They come in every variety you can imagine; some that you can't imagine and some that you can't figure out why they bothered to make in the first place. Calculator watches are one example of unusual watches. I find that all those little pushbuttons on the front are a pain. It's bad enough that they are so tiny that if you don't have little fingers (I don't) you can't use them, but the buttons take up so much room that the average calculator watch is big, ugly and cumbersome. Well, Casio has come up with a

solution to that problem, too. Their new *Touch Sensor* watch is a calculator watch that doesn't have a bunch of keys on the front panel. No! You don't use ESP to operate the calculator. When this watch is in the calculator mode, the liquid-crystal display indicates the keys on the transparent face of the watch and that face then becomes a pressure-sensitive keyboard. Neat! If I do say so myself.

Then of course there are watches that monitor your pulse rate,



INSTEAD OF KEYS, this calculator/wristwatch from Casio uses a touch sensitive watch face.

that have analog and digital displays, lifetime calendars, sing you a song when it's time to get up, and even tell you the temperature (in both Celsius and Fahrenheit). If you can think of some feature that isn't yet available, look for it; it will be there next week.

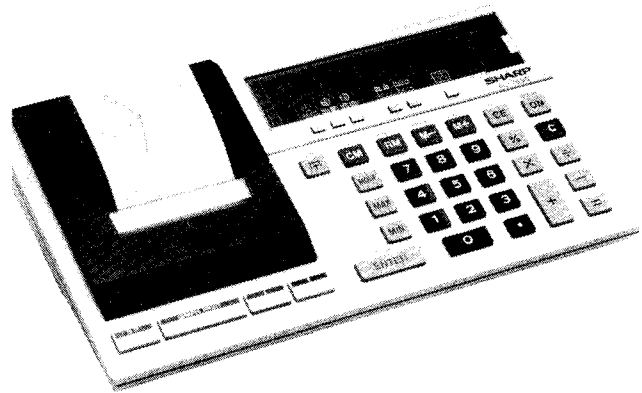
Musical greeting cards

That's not new. I've bought those through the years. They come with little mechanical music boxes. True, but that's not the kind I'm talking about. I mean greeting cards that look like plain ordinary greeting cards until you open them and they start to play. That's when you either send for the men in white jackets or for a tool kit to find out what's inside. When you've finally heard enough and are ready to dig in to see what's inside, you're going to be surprised. It's only an IC, a flat battery, and a flat ceramic transducer. They're not inexpensive. You'll have to spring for \$24.95 for a set of four cards. That's one to take apart and three to send to important friends and relatives. What a way to impress that new special person in your life. Send them the card that plays "Let Me Call You Sweetheart."

This calculator draws graphs

Some calculators add and subtract and multiply and divide. Some offer scientific functions. Others have memories and are programmable. Here is one that does all of those things but also draws graphs and draws them in an array of colors. I'm talking about the Sharp *EL-7050* calculator. The input procedures are

simple; there's no new programming language to learn. Just enter the data needed to draw up your chart, select the type of graph, the color, and the shading. Using this calculator you can generate bar graphs to show relative value or quantity; or circle



THIS SHARP EL-7050 calculator can generate a variety of graphs and print them out in an array of colors.

graphs to show distribution of parts of a whole; or broken line graphs for trends and transitions; or band graphs for a combined effect. You also have your choice of four colors and various shadings to add contrast or emphasis. The last word in pocket calculators? Probably not. Just wait till the mailman delivers your next catalog.

Electronic typewriters for everyone

Revolution has struck the typewriter. That old dependable machine is not what it used to be. If you don't know what I'm talking about, let me direct you to look at two new typewriters from Brother. First is the *EP-20*. This portable machine weighs less than 5 pounds, is battery powered, and..... Well, let's start all over again. The *EP-20* is small enough to fit into your briefcase with plenty of room to spare. In fact, its thickest point (at the paper feed) is a thin 1½ inches. This is a full-function, correcting, electronic typewriter. The dot-matrix printer operates with a 16-character delay. Those first 16 characters appear on the liquid-crystal display at the top center of the keyboard before they are printed so you can read and correct as you go along. If error-free copy is not necessary you can override the delay.

The keyboard provides you with the same widely spaced keys and characters found on most standard typewriter keyboards. And there's a second shift feature that lets you access 44 international-language and arithmetic symbols. Complete tab functions, automatic paper feed, self-repeat for all keys—even a four-function calculator (printing or non-printing) are built right in.

If you need a machine that's a bit more elaborate step up to the Brother *CE-60*. This one is a 17½-pound portable that has many features of office machines and can, by connecting a simple interface module, become a computer printer. As a typewriter the *CE-60* includes automatic underlining, centering, and correction (it remembers what you have typed—automatically correcting up to one entire line with a single keystroke). Then there's a relocation key that returns you to where you left off before you made that correction. When you reach the end of a line you don't have to hit the carriage return. The typewriter will do it for you. Once you establish your right-hand margin, the carriage returns automatically—without breaking a word—and continues to print on the next line. I guess some time soon, Brother will add a microprocessor, 64k of memory and turn this unit into a full computer/printer.

Telephones and computers do mix

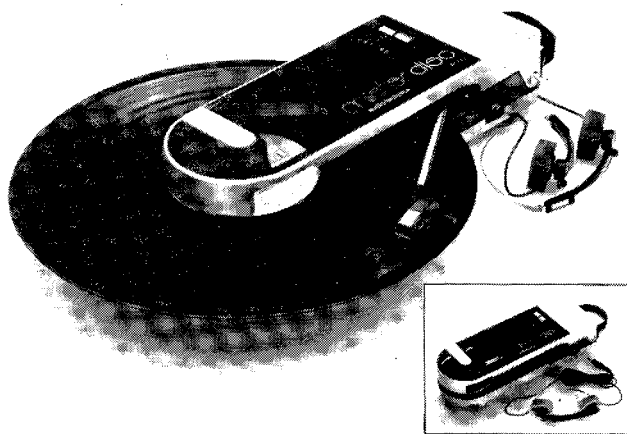
Take a telephone, add a 10-number automatic dialer, mix in an LCD clock, an AM/FM radio, and top it off with the con-

venience of a speakerphone. Now put all that into one attractive, tomorrow-styled package and you've got the *Electra*. It's just one example of what's happening in electronic telephones. While this one is visually exciting, there are many other similar combinations that look just like an ordinary bedside clock/radio. And, of course, dialers with extensive memories and telephones with their own built-in memories are commonplace. At the last Consumer Electronics Show there must have been more than 100 displays of all types of telephone equipment. Probably at the top end of the home telephone scale is the *Sensorphone*. Made by Gulf & Western, it turns your phone into an "electronic caretaker". It is so smart that it even talks to you in plain English while you program it. In fact, at every single command, *Sensorphone* will tell you what you've done. So what does it do?

It monitors your AC power line to tell if it is on. It monitors room temperature. It even checks for any unusual loud sounds such as those from a smoke or burglar alarm. If it discovers that AC power is off for more than five minutes, it will call you and tell you. If the temperature it is monitoring drops below the limit you have preset it will let you know. If your smoke or burglar alarm goes off and continues for more than 10 seconds, *Sensorphone* calls you, tells you and lets you listen to noise for 15 seconds. In fact, it will call you at a series of four different numbers until it reaches you. It can't be tricked either, because will keep right on calling until *you tell it to stop*. It's also a telephone dialer. What will they think of next?

Portable record player is really portable

Taking along a record player for 12-inch LP's wasn't an easy chore until very recently. At best it was a matter of gathering together a semi-portable compact stereo system and carting it to where you were going. Now, an interesting and practical option is available. From Audio-Technica comes *Mister Disc*. It's a completely self-contained, high-quality, portable stereo phono system that plays both LP's and 45's. This unique player mea-



THOUGH NOT QUITE POCKET SIZED, this turntable from Audio-Technica measures just 11.4 x 4 x 2.5 inches but can play full-sized LP's.

sures 11.4 x 4 x 2.5 inches, weighs 2.5 pounds, and is battery powered. It comes with an Audio-Technica vector-aligned dual magnetic cartridge with a diamond stylus and a dynamically balanced pickup arm that doesn't need leveling. For private listening there's a set of lightweight headphones that deliver great stereo sound.

Electronics and your lifeline

Consumer medical monitoring equipment will do wonders for you. It can measure your pulse, your blood pressure, your weight. It can check you out while you exercise. And while it is not a substitute for your doctor, you can use this gear to check yourself out during the span between visits. There are also special accessories like a *Compucal* scale that Sharper Image calls a "Truth-In-Food Computer." What does it do? Simple!

WHERE CAN I GET MINE

Listed here are the names and addresses of companies that issue catalogs, containing the types of equipment described in this article. If you want one of their catalogs use the reader-service number below their name and address. This list probably does not list every catalog house. If you know of one that is not shown here, please let us know, so we can add it to future listings.

DAK Industries Inc
10845 Vanowen Street
North Hollywood CA 91605

Circle 131 for catalog

Markline
P.O. Box C-5
Belmont MA 02178

Circle 134 for catalog

New Horizons
5 - 31 50th Avenue
Long Island City NY 11101

Circle 135 for catalog

Robert Edmund Co.
300 Edscorp Building
Barrington NJ 08007

Circle 132 for catalog

The Sharper Image
406 Jackson Street
San Francisco CA 94111
(800) 344-4444

Circle 136 for catalog

JS&A
One JS&A Plaza
Northbrook IL 60062

Circle 133 for catalog

The Shelburne Company
110 Painters Mill Road
Owings Mills MD 21117

Circle 138 for catalog

Dietary statistics for more than 700 generic and name-brand foods are stored in its main memory—even Big Macs and Oreo cookies. Simply place the portion of food you are about to eat on the scale, enter the code for the type of food being weighed, and *Compucal* displays the number of calories in that portion. Push another button or two and you'll know the sodium, carbohydrate, fat, and cholesterol content, too. And separate user memories let up to nine people keep track of their total dietary intakes by the day, week, or month.

On a more serious note, Sharper Image shows an automatic blood-pressure monitor developed by Digitronic. It prints out your blood pressure—both systolic and diastolic pressures—your pulse rate, and both the time and date that you took the measurement. You can't even make a mistake, because once you wrap the pressure cuff around your arm, the machine takes over. It automatically inflates and deflates the cuff and takes all the necessary measurements at just the right time.

What else is new?

Obviously, I've only been able to spotlight the many new and exciting electronic innovations that are invading our lifestyle. If you have found this article interesting, why don't you drop us a line and tell us about some new, exciting electronic device you have seen? Just tell us about it; clip a photo or catalog listing, tell us where it can be purchased, and we'll see if we can't present it to our readers in a future issue. Send your electronic innovation to Electronic Innovations, c/o **Radio-Electronics**, 200 Park Avenue South, New York, NY 10003. And don't forget to include your full name and address, in case we need more information.

In looking over the items we have described here, we're left with the thought that our readers might like to be able to look inside these products—get to see some of the circuitry that makes them work. If this is your feeling, tell us so and we will do our best to bring the information to you.

R-E



UNIQUE TEST EQUIPMENT

CHESTER H. LAWRENCE

*A look at what's new, what's sophisticated, and what's unusual
in test equipment today.*

ELECTRONIC TEST EQUIPMENT ARE THE POTS AND PANS OF AN electronics lab. Without the meters, scopes, generators and all the other devices we use to measure, examine and regulate the electronic equipment that surrounds us in today's world we would soon drown in a maze of very beautiful and sophisticated, but inoperative electronics hardware.

But what is test equipment? The answer to that simple question is complicated. It depends on who you are and what you do. To some, a multimeter is test equipment. In fact, it may be the only test equipment they need, own or use. To others it's a scope, or a function generator, or an RF signal generator. Most of us have used a digital multimeter, scope, generator, and various component testers. But have you ever used a logic analyzer; a network analyzer; or a portable oscilloscope that has a liquid-crystal display and also sports a memory? These are just some of the very sophisticated and unusual electronic test equipment that can be found in labs around the world. Let's take a look at some of these special instruments and see what they do, how they work and why we use them.

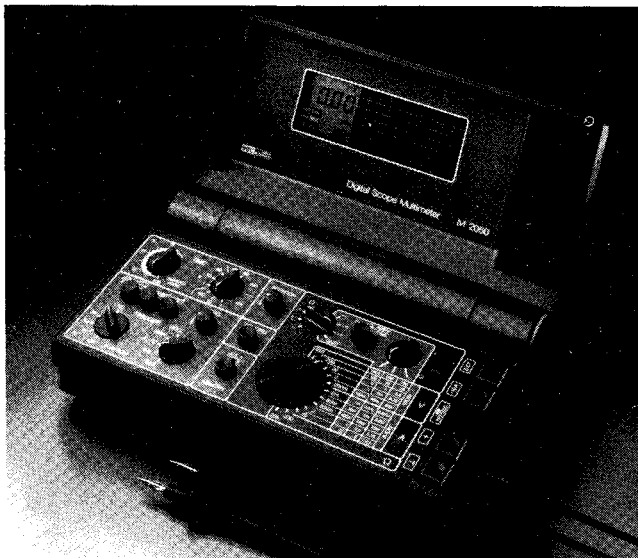
LCD digital storage scope multimeter

On the front cover of this issue is one of the most fascinating pieces of test equipment that I have seen lately. It's a simple portable oscilloscope. But that's where the simple ends and the exciting new technology begins. Note the liquid-crystal display and the memory. Take a measurement, carry the instrument away and the measurement is still there in the scope's memory.

The *M 2050* from BBC Metrawatt is a unique combination of a low-frequency digital oscilloscope, a 3½ digit multimeter and a transient recorder with two independent memories tucked into one neat portable package. An expensive oscilloscope if you compare it to conventional equipment, but if you look at the kinds of special jobs it can perform you will soon agree that the price is fully justified.

If there is any disadvantage to the unit it is in its frequency range. Because of the limitations imposed by the display, top frequency is 50 kHz. The price of this unit is \$1795.

First take a look at how small this instrument is—a mere 257mm × 169mm × 88mm when folded, and it weighs only 1.95 kg. Since the display is an LCD device it draws very little power and the battery-powered unit runs other battery-powered scopes into the ground. Thanks to the memory you can capture a waveform while working in a cramped corner, then walk away and examine that pattern and compare it with the ones in your service data later. All-in-all a great example of what technology can do.



NEW FLAT-PANEL OSCILLOSCOPE, model M 2050, from BBC-Metrawatt/Goerz combines the functions of a digital oscilloscope, a 3½-digit multimeter, and a transient recorder into a single, portable instrument.

When using the instrument, measurements can be evaluated more accurately because the scope and multimeter operate simultaneously. For example, while the scope portion of the display is used to evaluate signal characteristics, the DMM portion can be used to display the true RMS value of the signal. Because the inputs were designed with the voltage- and current-handling characteristics of a digital multimeter in mind, the Digital Scope Multimeter can be used directly for high-voltage measurements. Up to 500 volts can be applied to the 200-mV range without damaging the instrument. On all other voltage ranges 780-volt overload protection is provided.

Operating as a scope, the *M 2050* digitizes analog signals at a 500 kHz rate. At 10 samples per cycle, the effective bandwidth is 50 kHz. The transient recording capability of the instrument enables the operator to use two independent 0.5K × 8-bit memories to record data. It can capture events as brief as 2 ms. Once recorded, data from either memory can be recalled and displayed for analysis. Waveforms can be retained in memory for months. An analog output makes it possible to make a hard copy of the data when connected to a strip recorder.

Logic analyzer

As stated in the latest Hewlett-Packard catalog, logic analyzers are powerful measurement tools for today's complex digital systems. They are essential during the critical phase of integrating hardware and software. Costly design errors can be avoided.

When digital products are in production or operational, a logic analyzer is the instrument that quickly isolates a problem and decreases downtime. In a new line of logic analyzers recently introduced by Racal-Dana a new dimension is added to this instrument's capability—a fast, easy-to-use, effective software debugging tool. The model 205, an example of a top-of-the-line instrument, is priced at \$6995. It offers 48 channels of state analysis and 16 channels of waveform plus many significant features, including a 16-channel word generator, 12K bytes of non-volatile memory and a GPIB (General Purpose Interface Bus) interface. A more detailed discussion of the GPIB appears later in this article.

Applications for logic analyzers are not limited to the laboratory. Data and information gathered by using these instruments during design and development does not have to be put up on a shelf leaving the people in production, testing, quality control, and service to rediscover facts already known. With good planning and design, physical connections and simple routines for logic analyzers can be built right into the equipment the instrument has helped to design. This will provide for quick troubleshooting and efficient maintenance even after the product is in use.



FULL-FEATURED LOGIC ANALYZER from Racal-Dana offers 48 channels of state analysis and 16 channels of waveform. The model 205 also includes a 16-channel word generator, 12K bytes of non-volatile memory and a GPIB interface standard.



NEW LINE OF DIGITAL MULTIMETERS, the 70 Series from Fluke, introduces some significant changes in DMM technology. The bar pattern across the bottom of the digital display is an analog display that greatly enhances the capabilities of the instruments.

Digital multimeters

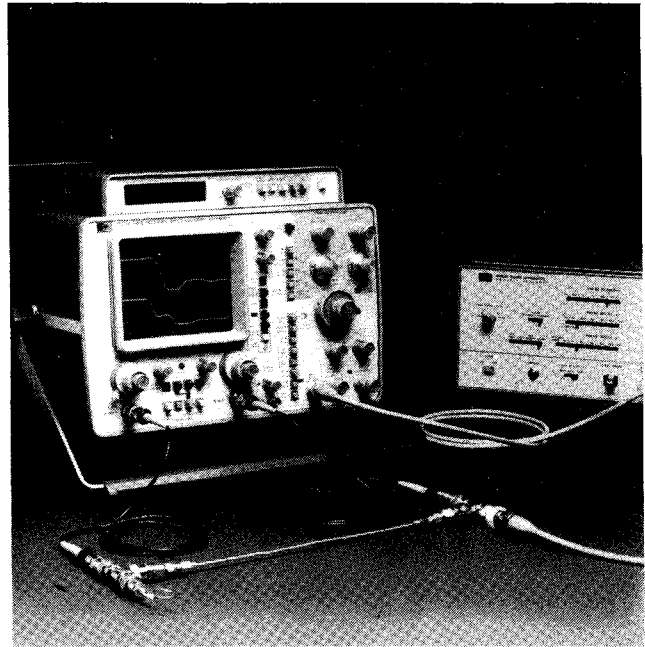
If you want to look at extremes, here are two instruments, both with the same name, but each at opposite ends of the DMM spectrum. The John Fluke Manufacturing Company is a major manufacturer of digital multimeters. At the top end of the spectrum they produce their model 8506A, a unit that they claim delivers performance at the edge of technology. I must agree. This instrument has $7\frac{1}{2}$ digits of resolution, a 24-hour accuracy of 120-parts-per million from 40 Hz to 20 kHz and a stability of 30 parts-per-million. The instrument's top notch accuracy is attributed to the use of a thermal-RMS detection technique based on the heat dissipated by a resistor. As a result the instrument's response is relatively independent of the input signal's waveform and full accuracy can be guaranteed for a wide range of input signals.

The only problem with this instrument is that it represents drastic overkill for most digital-multimeter applications. It's a lot like hiring a Greyhound bus to take one person from place to place instead of using a taxi.

At the other end of the spectrum is Fluke's newest and least expensive digital multimeters, a line of three instruments in the 70 Series. Starting at \$85 and packed with a variety of high-priced features, including an analog liquid-crystal display for reading peaks, I think that this meter represents a new standard for the test-equipment industry and fortells the future of portable-multimeter technology. For more details on this instrument see the Equipment Report elsewhere in this issue.

Synthesized signal generator

Over its entire range of 80 kHz to 520 MHz, all you need do is punch out the frequency, the modulation and the RF level of the desired signal on the front-panel keyboard and you have it at the output. Designed by Marconi Instruments to test transmitters and transceivers, frequency resolution is within 10 Hz at all frequencies. RF output up to +13 dBm is available at all frequencies and microprocessor control provides operating simplicity and speeds up routine measurements. A non-volatile memory stores up to 10 generator settings and a further 40 carrier-frequency values. The memory also stores calibration information. Microprocessor-aided fault diagnosis lets the user, from the front panel of the instrument, pinpoint the section of this instrument that is not functioning properly.



PROPAGATION DELAY CAN BE MEASURED ACCURATELY with the HP 1726A time-interval oscilloscope. In this photo a 10-inch length of semi-rigid coax cable has a delay of -1.43 ns. The minus sign indicates that the channel A signal occurs later than the channel B signal.

Time-interval oscilloscope

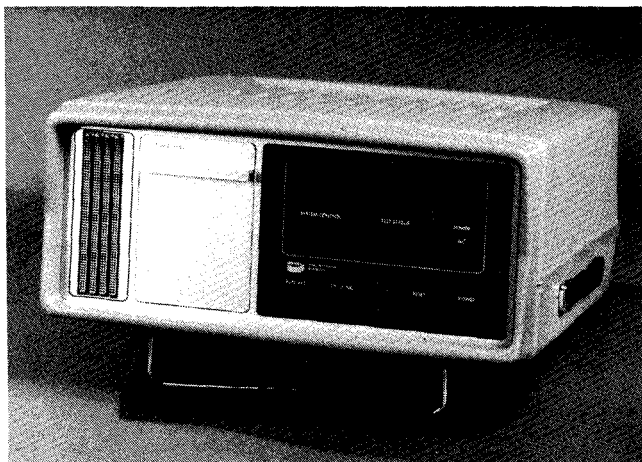
Offering 50-picosecond accuracy and 10-picosecond resolution the new Hewlett Packard HP 1726 scope makes fast, reliable timing measurements on complex repetitive signals. The instrument combines counter and oscilloscope technologies. It has the viewing and measuring capabilities of a 275-MHz scope and the ease of use of a time-interval counter. That is particularly useful to those making frequent timing measurements.

Designed to make precise timing measurements, the HP 1726 uses a crystal-referenced time base in conjunction with a CRT and stable triggering circuits. This combination makes it possible for the instrument to display the signal being tested as well as to measure the designated interval with up to 50-picosecond accuracy. At \$7,675, the HP 1726 is far from cheap, but for the high-technology and high-performance portion of the electronics industry it meets the requirement found in fundamental areas of research-and-development labs, production, and service. As a diagnostic tool the unit is excellent for characterizing designs, processes and entire test systems.

Digital module tester

The most advanced automatic test equipment technology in a compact 28-pound package is the way Bendix introduces its model 9070 digital module tester. The primary purpose of this instrument is to separate bad circuit-card assemblies from good ones. It can handle GO/NOGO screening and fault isolation diagnostics on everything from a simple circuit card to a complex system. It works in the field, on the bench, or on the production line. The highly sophisticated instrument tells the operator what to do—step by step; it signals when a fault is detected and displays test results instantly.

In the field, the portability of the 9070 makes it possible to take the tester to the problem and find the fault there. This does away with board swapping and cuts down on the number of boards in the service pipeline. Good boards stay on the job. Obviously this is not used in simple systems or where the boards being tested are relatively inexpensive. In those instances, simple board swapping is more efficient and less expensive. At the repair shop the unit finds faults that need repair in bad boards quickly and automatically, delivering the kind of quick turnaround and throughput that is needed for an efficient shop testing operation.



DIGITAL MODULE TESTER does its job by applying input signals at designated input pins and certifying predicted responses at designated output pins. This tester is the Bendix Model 9070.

To do its job the 9070 applies input signals at designated input pins and verifies predicted responses at designated output pins. Any sequence or combination of the following input signals may be used for each individual test:

- Input logic pattern
- Change of state at one pin or simultaneous change of state at multiple pins
- Sequential change of state at selected pins
- Single or multiple clock pulses at individual or group of pins

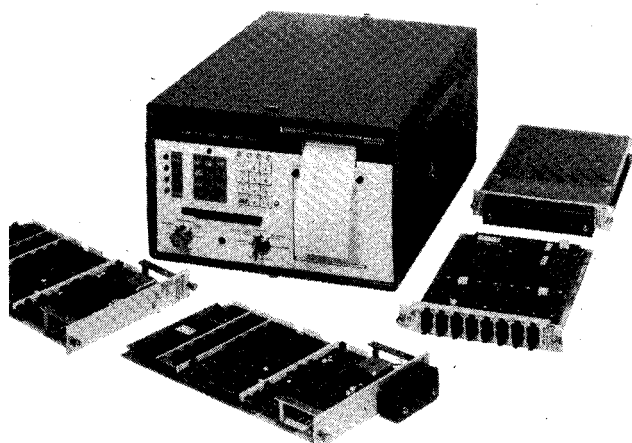
Output response may be verified by any of the following methods:

- Full output go pattern
- Change in output at single or multiple pins from prior test
- Specific logic level at single or multiple pins

Maximum system capability is 256 active input/output pins. All pins are programmable; no dedicated adapter is required.

Universal disturbance analyzer

Anomalies on the AC power lines can affect computers and other sensitive microprocessor-based instruments. To counter this problem is the Dranetz Technologies Series 626—*Universal Disturbance Analyzer*. This is a modular, portable microprocessor-based instrument made up of a mainframe and up to five individual plug-in modules. By choosing the appropriate plug-ins the user can monitor single-phase AC, 3-phase AC, DC voltages, common-mode AC voltages, and logic event changes-of-state.



TOGETHER WITH SOME OF ITS INPUT MODULES is the Series 626 Universal Disturbance Analyzer from Dranetz. This unit can spot and record anomalies that affect computers and other sensitive microprocessor-based instruments.

The *Universal Disturbance Analyzer* is specifically designed for use in the computer field-service industry and continuous on-site monitoring of computer operations. Voltage disturbances are printed out in industry-standard terms of sags, surges, and impulses (including impulse duration). In addition, the 626 will have applications in the analysis of power problems associated with telecommunications systems, industrial process-control systems, medical instrumentation and, of course, the entire range of microprocessor-based equipment.

Testing cellular-radio receivers

What do you use to test these state-of-the-art receivers? Boonton Electronics says try their model 1021 programmable RF signal generator. It has a frequency range to 1.08 GHz and covers all of the requirements for high-speed testing of cellular receivers. Switching time between channels is 50 ms. Output levels to +16 dBm, SSB noise of less than -113 dBm, residual FM below 12 Hz at 900 MHz, and FM distortion of 0.05%. In addition, the low-distortion, internal, modulation oscillator can be used as an audio oscillator with programmable frequency and level. The generator can be controlled manually, automatic via GPIB, or preset to recall up to 250 complete panel setups from an integral non-volatile memory. Oh, about the price....a mere \$16,950.

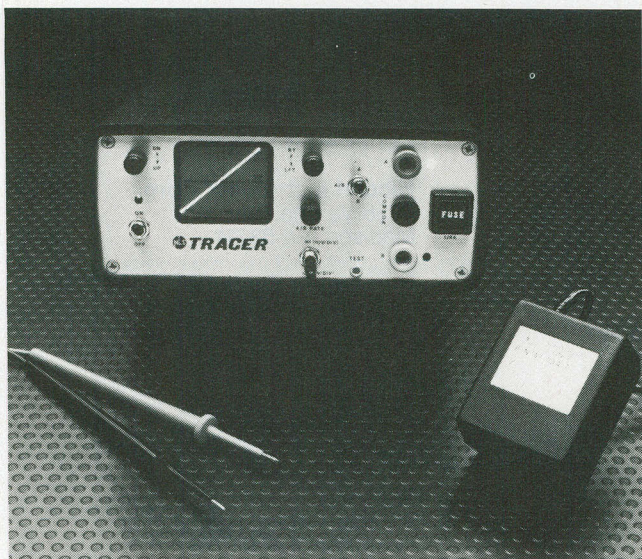


IF YOU'RE SERVICING CELLULAR RADIO equipment, a programmable RF signal generator like the Boonton Electronics model 1021 is what you need. The special feature is that it covers the requirements for high-speed testing of cellular receivers.

Component and circuit tester

The *TR-1 Tracer* from Non-Linear Systems is not an expensive instrument, but it is a fascinating one because of the wide range of tests it will perform. How does one describe it? Well it is an in-circuit and out-of-circuit tester of components and networks. Signature analysis patterns provide the key to rapid fault finding. The unit tests all parameters simultaneously of circuit boards or individual components without power-up. Dual inputs make it snap to compare a known good component with a suspect.

When testing equipment the *TR-1* locates shorts, opens, and wrong parts in a minimum of time. Since the unit works equally well in or out-of-circuit it can also be used in receiving inspection for qualitatively checking a variety of components. Because the unit conducts dynamic testing rather than static testing it can detect faulty parts suffering from defects such as noise leakage, temperature instability and intermittent deficiencies that might go undetected using other methods. You are sure to find many additional applications for this device. Battery powered and easily portable, it's a handy companion in the field.

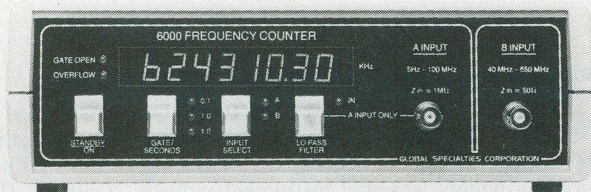


IN-CIRCUIT OR OUT-OF-CIRCUIT the Non-Linear Systems Tracer checks out and troubleshoots circuits, subassemblies and components rapidly and accurately. All tests can be performed without powering-up the circuit being checked.

Inexpensive frequency counter

Not all good things must be expensive. Here's a frequency counter that ranges from 5 Hz to 1 GHz, yet costs only \$575. It's the Global Specialties model 6002. It also measures period from 1 μ s to 200 ms. Also, there are three selectable resolutions with LED indicators and simple push-button control. A 10-MHz crystal oven oscillator time-base assures ± 0.5 ppm, ± 1 ppm/year stability.

The unit is intended for use for audio/VHF in communications, data processing, process control, RF design, digital design, quality control, and maintenance. There's an 8½-digit display featuring leading-zero blanking, 0.43-inch tall characters and a contrast-enhancement filter.

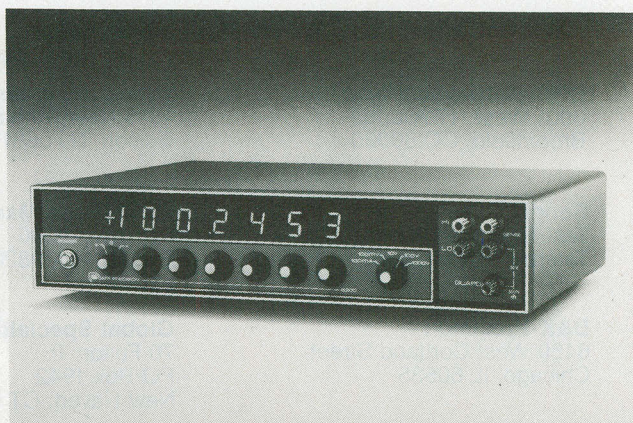


ARE 8½ DIGITS ENOUGH in a frequency-counter display? The model 6000 frequency counter from Global Specialties provides that display of the frequencies it measures.

Calibration standard

DC voltage/current portable calibration standard that's NBS (National Bureau of Standards) traceable is a handy instrument to have around. And the Data Precision model 8200 delivers higher effective resolution, higher stability, exceptional accuracy and great flexibility in a unique new way. This instrument is an extremely accurate microcomputer-based, remotely programmable, line-powered portable standard for the transfer of NBS reference values to instrumentation and equipment in a broad range of working environments—in the lab, in the quality-acceptance quality-control department, and on the production floor.

When operating in the manual mode, the 8200's 6-digit control network is controlled by setting its associated rotary switches to any reading between 000000 and 1048575 plus polarity indication, with appropriate decimal point location. (The internal microcomputer translates from binary to BCD, so you read



INCREMATIC DC VOLTAGE/CURRENT portable calibration standard allows unlimited use of any one decade with full borrow/carry to and from all more significant digits. This instrument is the model 8200 from Data Precision.

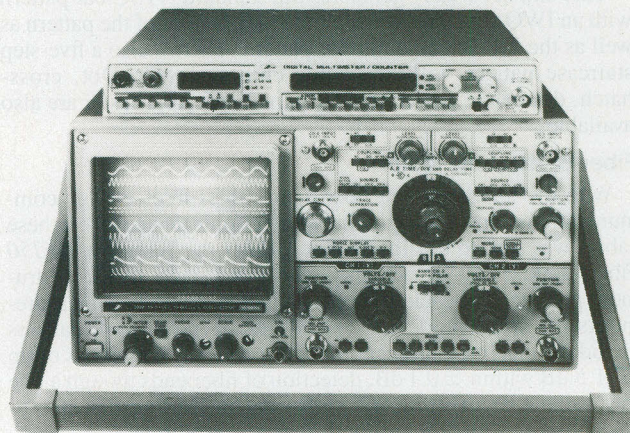
the output in decimal values.) The desired values appear above the rotary switches displayed on a set of LED's. The unusual *Incremental Control Feature* enables the operator, using any one rotary switch to control not only that particular decade, but all of the successive significant digits.

Thus external instruments can be exercised down to any resolution, step after step, using only one knob for a particular test-run resolution. This feature is extremely useful when measuring linearity of D/A and A/D converters, as well as the transfer function and linearity of analog function modules such as multipliers and dividers.

Arbitrary waveform generator

So you want to generate custom waveforms. The Wavetek model 175 will do that job for you. It lets you tailor your own waveform. Any waveform that can be drawn can be entered into this versatile instrument and then generated as an output.

This unusual device stores waveforms as digital points on a 256 \times 255 data grid. These points are sampled by a crystal-controlled clock at selectable times up to 200 nanoseconds. Amplitude can be varied a full 20 volts peak-to-peak with 3-digit resolution. Waveform shape data is entered in any one of four RAM memories through the front-panel keyboard or the GPIB. You enter the data for each change-of-slope location and the internal microprocessor connects these points. In addition, plug-in sockets are provided for four PROM's so you can create a permanent library of your most used waveforms. One place that this instrument is invaluable is in medical electronics where we can create the many irregular waveforms that are often required.



THE MODEL SS-5711D four-input, eight-trace, portable oscilloscope from Iwatsu. It also features a digital multimeter.

MANUFACTURER LIST

BBC-Metrawatt/Goerz
6901 West 117 Avenue
Broomfield, CO 80020

Bendix Corporation
Test Systems Division
Teterboro, NJ 07608

B&K Precision
6460 West Cortland Street
Chicago, IL 60635

Boonton Electronics
499 Pomeroy Rd.
Parsippany, NJ 07054

Data Precision Corp.
Elect Avenue
Danvers Indl Pk
Danvers, MA 01923

Dranetz Engineering Labs
1000 New Durham Road
Edison, NJ 08817

John Fluke Manufacturing Co.
PO Box C9090
Everett, WA 98206

Global Specialties Corp.
70 Fulton Tr.
PO Box 1942
New Haven, CT 06509

Hewlett-Packard
3000 Hanover St.
Palo Alto, CA 94304

Iwatsu Instruments
120 Commerce Rd.
Carlstadt, NJ 07072

Marconi Instruments
100 Stonehurst Ct.
Northville, NJ 07647

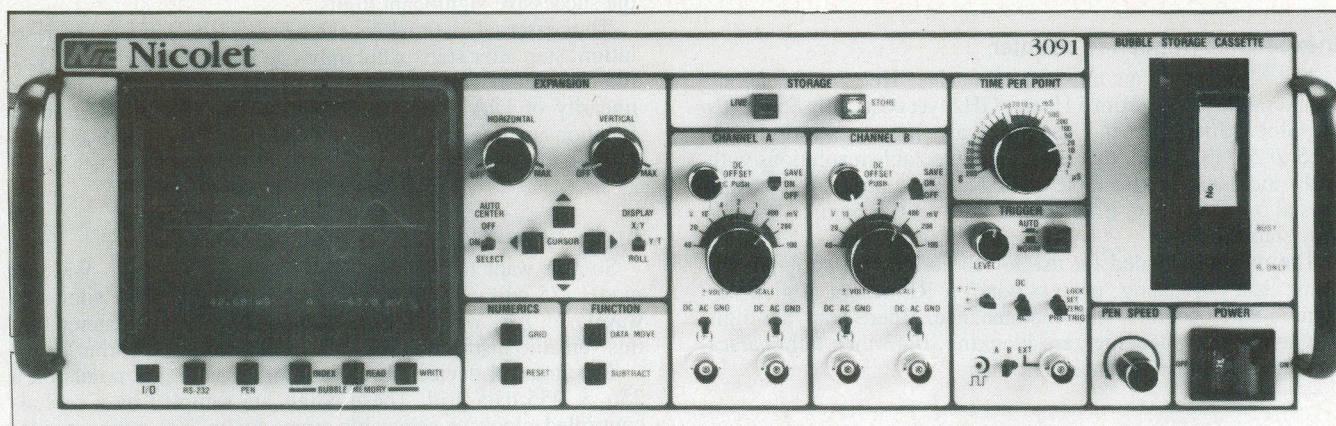
Nicolet Instrument Corp.
5225 Verona Rd.
Madison, WI 53711

Non-Linear Systems
533 Stevens Avenue
Solana Beach, CA 92075

Racal-Dana
4 Goodyear St.
PO Box C-19541
Irvine, CA 92713

Tektronix
PO Box 1700
Beaverton, OR 97075

Wavetek Inc.
9045 Balboa Avenue
San Diego, CA 92123



THIS RACK-MOUNT oscilloscope, the 3901 from Nicolet, features a digital readout and a bubble memory for storage.

NTSC Color-Bar Generator

With all the attention that video gets these days, thanks to the VCR, videodisc player and video cameras, a good NTSC generator is increasingly valuable. One moderately-priced, yet quality unit is the model 1250 made by B&K. It is a cost-effective unit for broadcast, CATV, and industrial television applications. It's also useful for aligning and troubleshooting VCR's.

This unit accurately generates the standard NTSC bar pattern with an IWQ signal occupying the lower quarter of the pattern as well as the full-screen color-bar pattern. There's also a five-step staircase pattern with selectable chroma levels. Dot, cross-hatch, dot-hatch, center-cross patterns, and color raster are also available.

Fiber-optic cable tester

With the importance of fiber-optic cables in electronic communications constantly growing an electronic device to test these cables was sure to be close behind. Enter the Tektronix OF150 Fiber Optic TDR. This high-performance, easy to use instrument performs repeatable, accurate distance and loss measurements on multi-mode optical cables. Typical applications include: splice measurement though a one-way cable loss of up to 21.5 dB within ± 0.1 dB; detection of fiber ends though a one way cable loss of up to 42.5 dB; and measuring distance to discontinuities to 19.9 km, with 1-meter resolution.

The OM150 delivers direct LCD readout of results. A built-in chart recorder provides a permanent record of the waveform.

GPIB compatibility

The General Purpose Interface Bus (GPIB) was established in 1975. Three years later, in 1978 the IEEE standard defining this bus was further refined, defining an interfacing system that has become a widely accepted instrument industry standard. The major areas it specifies are:

Mechanical—the interface connector and cable.

Electrical—the logic signal levels and how the signals are sent and received.

Functional—the tasks an instrument's interface may perform (such as sending data, receiving data, triggering the instrument) and the protocols to be used.

Today, a wide variety of instruments include interfaces conforming to this mechanical, electrical and functional standard. With GPIB compatibility, measurement capability can be chosen off-the-shelf and simply cabled with standard bus cables in either a linear or star configuration.

Some closing comments

Obviously an article of this nature cannot include every exciting new instrument, nor can we possibly mention every manufacturer of quality test equipment. Please don't think that the instruments and manufacturers mentioned in this article are the only ones that we have seen. Scores of new instruments are announced each month and what we have tried to do here is bring you a sampling and cross-section of those that have interesting and sometimes different features.

R-E

ECL LOGIC CIRCUITS

TJ BYERS

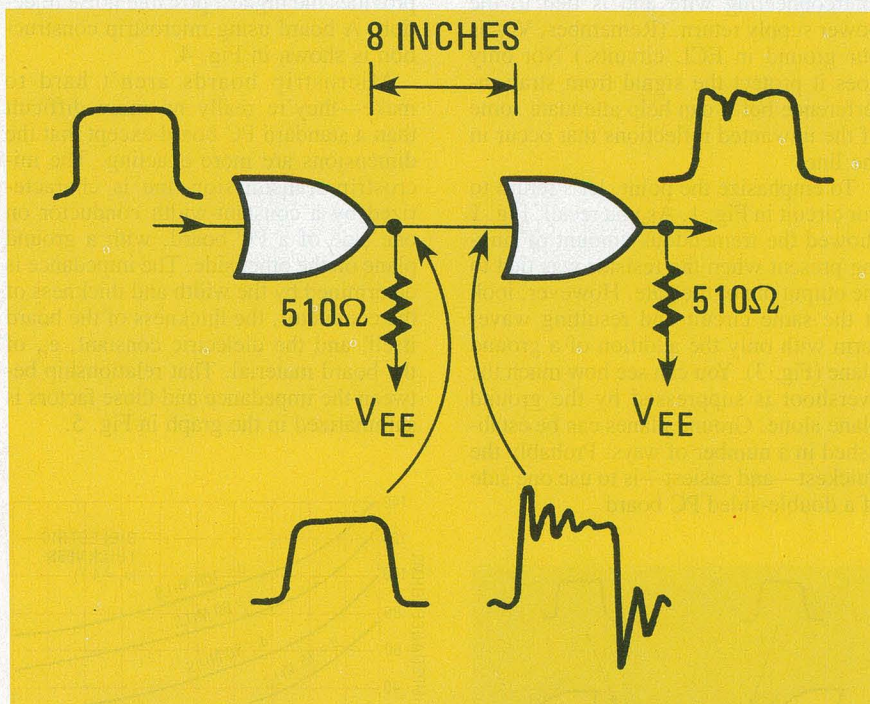


FIG. 1—RINGING IS A MAJOR problem to consider when dealing with ECL-circuit wiring.

Because of the high operating speed of emitter-coupled logic, standard wiring procedures cannot be used. Here we will look at the solution to the circuit-wiring problem.

Part 2 IF YOU READ THE FIRST installment in this series, then you have a general understanding of ECL (Emitter-Coupled Logic) and its capabilities. However, to use ECL IC's, you have to understand more than the ECL gate. You have to pay close attention to the interconnections between devices. This month we'll investigate just that.

Wiring ECL gates

The application of ECL is identical to any other form of logic and, as with any other logic, the output of one gate must be connected to the input of the following gate. Normally, that is a routine kind of thing, and you simply run a wire from one to the other, just as we have done in Fig. 1. (Notice that, in compliance with the rules of ECL loading, a pull-down resistor is connected to the output pin of each gate.)

Before going any further, we should explain that at high frequencies, any wire connecting any two points (gate output to gate input, in our case) can be considered to be a transmission line. A transmission line has certain amounts of resistance, inductance, capacitance, and a time delay—all of which influence the signal traveling through it. We must also remember that if the transmission line is not terminated by its characteristic impedance, a portion of a signal flowing

through the line will be reflected when it reaches the line's termination. Those reflections add to (or subtract from) the signal voltage. Reflections are present even at low frequencies, but in that case, they are usually masked by the relatively slow risetime of the pulse. However, when the delay time in the wire is longer than the risetime of the input pulse, the reflected power causes a *ringing* inside the line that affects the pulse. (If the ringing is limited to the risetime of the pulse it is not usually a problem, because the IC's are clocked after the steady-state levels have been reached.) For example, the lead length specified for our example in Fig. 1 would give a delay that is longer than the risetimes commonly encountered when using ECL gates. The result is shown—notice that a clean pulse enters the line from the gate output. But by the time it reaches the following input, it is distorted by ringing. The ringing is due to the reflected waves present in the transmission line.

ECL is forgiving to a certain extent, and some ringing is permissible. However, ringing on the input line does reduce the noise "safety" margin considerably and in some cases will even produce false triggering. Typically, an ECL gate will tolerate up to 35% overshoot and 15% undershoot. That's not a wide margin to work within!

Fortunately, there is a simple way to

reduce ringing. By placing the load resistor at the end of the connecting lead—instead of at the gate output—the overshoot is attenuated. Instead of feeding a pulse down an open wire, the output circuit now sees a terminated low-impedance transmission line.

As shown in Fig. 2, that simple procedure gives us cleaner output waveforms. It now becomes apparent why the ECL-IC designers opted for an open-emitter driver and did not include a load resistor on the chip.

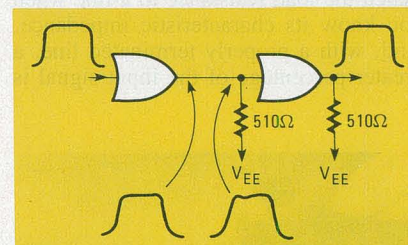


FIG. 2—CONNECTING THE OUTPUT RESISTOR at the end of the connecting lead can help to reduce ringing.

Ground planes

At higher frequencies, the noise picked up by an unshielded wire is prohibitive. One way to provide shielding, without using coaxial cables and the like, is to place the lead alongside a ground plane.

A ground plane is nothing more than a sheet of metal that is placed close to the interconnecting wire and is tied to the power supply return. (Remember, V_{CC} is our ground in ECL circuits.) Not only does it protect the signal from stray interference but it can help attenuate some of the unwanted reflections that occur in the line.

To emphasize the point, let's return to our circuit in Fig. 1. As you recall, Fig. 1 showed the tremendous amount of ringing present when the resistor was tied to the output pin of the gate. However, look at the same circuit and resulting waveform with only the addition of a ground plane (Fig. 3). You can see how much the overshoot is suppressed by the ground plane alone. Ground planes can be established in a number of ways. Probably the quickest—and easiest—is to use one side of a double-sided PC board.

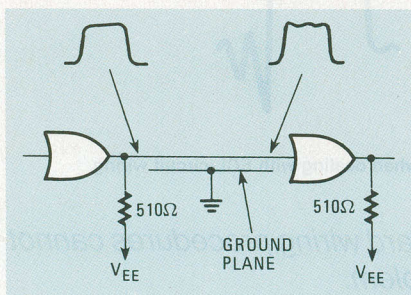


FIG. 3—USING A GROUND PLANE is another way to reduce overshoot and ringing.

Microstrip construction

A logical extension of the ground plane concept is microstrip construction. Microstrip design goes one step beyond the simple ground plane by allowing you to give a specific impedance to every line. In the ground-plane approach previously reviewed, no effort was taken to make sure that the impedance was constant. There are several advantages to being able to tailor the impedance of the transmission line. For one thing, it is much easier to match the load resistance to a line when you know its characteristic impedance. And, with a properly terminated line, a greater percentage of the input signal is

seen at the other end. Thus, a wider margin for error is obtained. Moreover, it provides the highest possible noise rejection. A board using microstrip construction is shown in Fig. 4.

Microstrip boards aren't hard to make—they're really no more difficult than a standard PC board except that the dimensions are more exacting. The microstrip transmission-line is characterized by a constant-width conductor on one side of a PC board, with a ground plane on the other side. The impedance is determined by the width and thickness of the conductor, the thickness of the board itself, and the dielectric constant, ϵ_r , of the board material. That relationship between the impedance and those factors is summarized in the graph in Fig. 5.

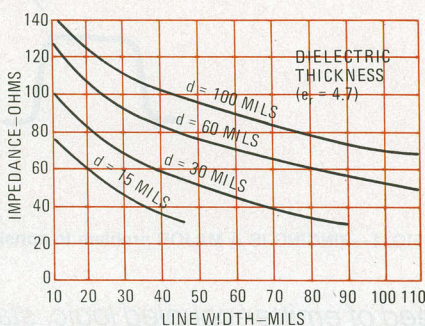


FIG. 5—THIS GRAPH SHOWS microstrip impedances for double-clad 1-ounce copper board; copper thickness = 0.0015 inches.

When laying out a microstrip board, certain precautions must be observed. First, there should be no squared corners in your leads—sharp bends should be avoided. For best performance, all bends should be given a radius no smaller than one-fourth the wavelength. Also, to minimize crosstalk, as much spacing as possible should be left between parallel lines. If you have no choice and have to separate two lines by less than 150 mils (0.15 inches), then a ground lead must be run between them.

For practical reasons, the characteristic impedance of the microstrip lines falls between 50 and 150 ohms. To achieve impedances greater than 150 ohms, the line width becomes prohibitively narrow; not that their construction isn't possible, but small imperfections in the etching process become more critical. That restriction, however, falls within the guidelines of good circuit design. As impedance increases, propagation time also increases. So, as far as speed is concerned, low-impedance lines are preferred. However, low-impedance lines require a low-value terminating resistance, which must—as we discussed last month—dissipate more power. An impedance of 68 ohms usually yields the best trade-off between power dissipation and speed—and happens to fall in the middle range of board construction. Of

course, you are not restricted to using 68-ohm lines exclusively. You can use any impedance you deem necessary for the job. You can even mix the impedances on a board to tailor the performance for specific results, as we shall see shortly.

Line terminations

Anytime a transmission line is longer than the signal wavelength, termination of the line is a necessity. By using constant-impedance transmission lines, though, it becomes possible to terminate the line in more than one way and still achieve a good match with reduced overshoot.

We have already seen one—the use of a terminating resistor at the end of the line. That is called parallel terminations. It provides the highest speed while reducing the capacitance effect on the output of the gate. When one output drives several loads, however, there are a couple of variations to the parallel termination.

The first approach is to lump all the loads at the end of one transmission line, as seen in Fig. 6. Although that slows the risetimes and falltimes somewhat, because of the increased capacitance, it is desirable when all the inputs involved are located on a single IC. Notice that only

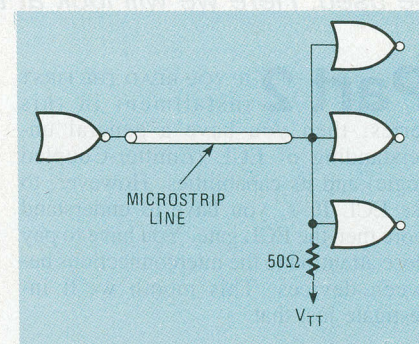


FIG. 6—PARALLEL TERMINATIONS. This approach uses only one load resistor.

one load resistor is used for all the inputs.

An attractive benefit of a parallel-terminated line is the fact that the impedance is constant along its entire length. This makes it possible to tap the signal from any location along that length, as shown in Fig. 7. For proper distribution, though, the taps should be evenly spaced along the length of the line. You must keep in mind, however, that as the pulse progresses down the line, the delay increases. In other words, the first gate will receive its signal before the end gate.

A variation of the single line is the multiple-line mode. A representation of this method is shown in Fig. 8. Notice that the path to each input is through a separate transmission line. When the loads are scattered throughout the card, it is better to use that arrangement. You'll

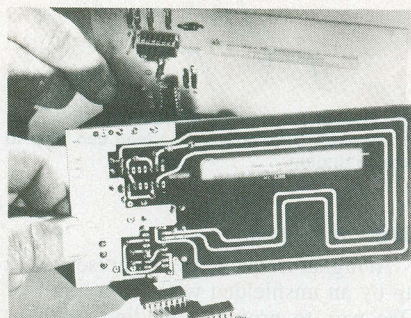


FIG. 4—THIS BOARD (an 83-MHz ring counter) uses 12-inch microstrip delay lines and a ground plane (seen in mirror).

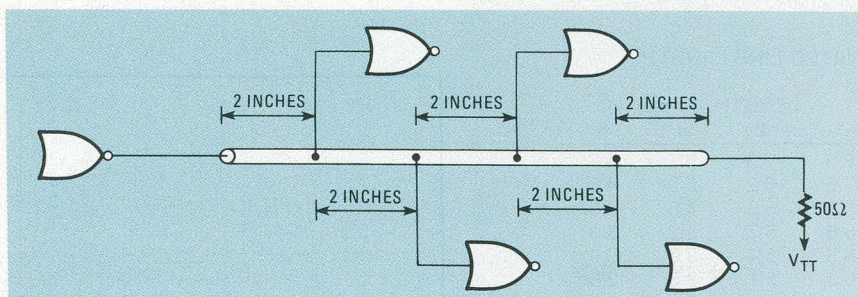


FIG. 7—BECAUSE THE IMPEDANCE is constant along its entire length, you can tap the signal at any point on the coaxial line.

also notice that each line is terminated by its characteristic resistance, which means that the power dissipation of the output gate increases as the number of lines increases. Therefore, it is best to use high-impedance lines so that the total lumped resistance doesn't exceed the DC limits of the output circuit. For instance, if we take the example in Fig. 8, the wise choice would be to run three 150-ohm lines to the inputs. In that way, the total load seen by the output will be 50 ohms—well within its operating parameters.

An obvious consequence of mixing impedances on a card, however, is that each impedance displays a different propagation time; delays increase as the impedance increases. Depending on the lengths involved, it's possible that pulse skewing could result even though you may have taken care to match wire lengths.

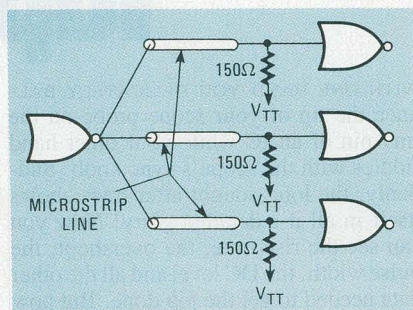


FIG. 8—THIS METHOD of PARALLEL termination uses multiple microstrip lines. The total impedance seen by the gate is 50 ohms.

Series terminations

The alternative to parallel terminations is series termination. Series termination is achieved by inserting a resistor in series with the transmission line, as shown in Fig. 9. The value of the series resistor is equal to the impedance of the line, less the output impedance of the gate. The typical output impedance of an ECL gate is 7 ohms; therefore, the proper series resistor for a 50-ohm line is 43 ohms. By placing the resistor in series with the line at the input, only half the voltage swing is transferred down the transmission line. When the signal reaches the end, however,

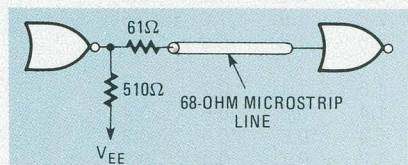


FIG. 9—SERIES TERMINATION is an alternative to parallel termination.

high-frequency reflections bouncing back and forth in the line combine to double the output voltage, thus re-establishing the original logic level.

To maintain clean wavefronts, though, the input impedance of the gate must be several times greater than the characteristic impedance of the transmission line. This requirement lends itself well to ECL circuits. Since the signal voltage is reinforced at the point of exit, it is possible to have more than one load on the output and still maintain proper voltage levels. However, the capacitance of the extra inputs has a greater effect on the rise and fall times than it does with parallel terminations. That is due in large part to the series resistor.

Some of the problem can be alleviated by decreasing the size of the series resis-

tor, thus decreasing the R-C time constant. Unfortunately, less resistance means more ringing. Therefore, the series resistance must not go below the point where the ringing exceeds the limits imposed by the input. That approach is known as series damping, and a chart of the lowest acceptable resistor values can be found in Table 1.

A single load on a line doesn't present that problem. Therefore, it is better to run parallel lines to each input as shown in Fig. 10, instead of clustering them on one line. That is an excellent way to distribute a signal over a card without the increased power dissipation that's associated with multiple parallel-terminated lines. As before, the value of the series resistor for each line is equal to the impedance of the line.

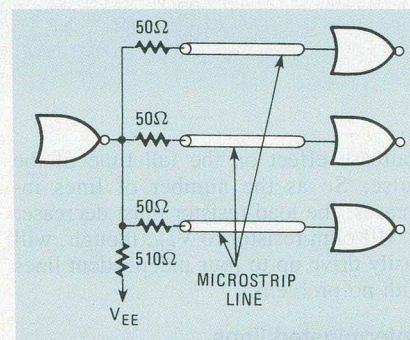


FIG. 10—SERIES TERMINATION using multiple microstrip lines helps to keep power dissipation down.

The size of the pulldown resistor, however, is affected by the number of lines the output must drive. If the value of the load resistor is too high, the output transistor will turn off during its transition from the high to the low state, creating a

TABLE 1—Minimum Series Resistance

Rise Time	Line impedance ohms	Series resistance ohms	Gate output impedance (ohms)
3.5 ns	50	9	15
"	68	18	"
"	75	21	"
"	82	25	"
"	90	29	"
"	100	34	"
"	120	43	"
"	140	53	"
"	160	63	"
"	180	72	"
1.1 ns	50	18	6
"	68	27	"
"	75	30	"
"	82	34	"
"	90	38	"
"	100	43	"
"	120	52	"
"	140	62	"
"	160	72	"
"	180	81	"

TABLE 2—MAXIMUM UNTERMINATED-LINE LENGTH

Rise Time	Line impedance (ohms)	FANOUT =	LENGTH (inches)			
			1	2	4	8
3.5 ns	50		8.3	7.5	6.7	5.7
"	68		7.0	6.2	5.0	4.0
"	75		6.9	5.9	4.6	3.6
"	82		6.6	5.7	4.2	3.3
"	90		6.5	5.4	3.9	3.0
"	100		6.3	5.1	3.6	2.6
2.0 ns	50		3.5	2.8	1.9	1.2
"	68		3.2	2.3	1.5	0.8
"	75		3.0	2.2	1.3	0.7
"	82		2.9	2.0	1.2	0.6
"	90		2.8	1.9	1.0	0.5
"	100		2.6	1.8	0.9	0.4
1.1 ns	50		1.6	1.1	0.7	0.6
"	68		1.4	0.8	0.5	0.4
"	75		1.3	0.8	0.4	0.3
"	82		1.2	0.7	0.4	0.2
"	90		1.1	0.6	0.3	0.2
"	100		1.0	0.5	0.2	0.1

staircase effect on the fall time of the pulse. So as the number of lines increases, the load resistor must decrease. A 510-ohm resistor to V_{EE} , though, will easily drive up to four independent lines with no problem.

Unterminated lines

If the length of the transmission line—or wire, for that matter—is shorter than the wavelength of the input signal, the signal will pass through the conductor virtually unaffected by the reflections. Since many of the connections within a circuit are short and direct, they can be made with unterminated lines.

In a pulse circuit, the dominant frequency is determined not by the pulse repetition rate, but by the rise time of the pulse. The signal undershoot, which is the most critical of the two parameters, is held to about 15% if the travel time for a two-way trip through the conductor is less than the risetime. However, the propagation time through the line is determined by more than one factor. Involved are the length of the conductor, the dielectric constant of the board, the capacitance of the load, and impedance of the line. Those factors are often interrelated and variable, but Table 2 ties them together. With that table you can determine, at a glance, the longest unterminated line that you can use in a given situation.

As you can see, the shortest runs occur with those ECL IC's that have the fastest risetime. It is for that reason that a separate family of ECL IC's, the 10000 series, was developed. With deliberately slowed risetimes, they are able to take advantage of longer unterminated connections, thus easing circuit constraints. Unfortunately, their slower response time may not meet your system requirements in all cases.

System interconnections

In larger systems, more than one card is often involved. In that case, of course, connections between cards must be made. That presents a unique situation in that we must use all the transmission-line knowledge we have discussed so far. Furthermore, the parameters we discussed become more critical—and a new one comes to light.

This new parameter is attenuation. At the single-board level, attenuation is seldom a problem. But it must be taken into consideration when interconnections between modules and cabinets are made. Let's first take a look at the options open to us.

Although the mother-board arrangements can be used for tying cards together under special circumstances, it is better to use point-to-point wiring since few edge-connectors perform well at the frequencies involved. Single wires can be used if you respect their limitations. To begin with, they fall under the restrictions imposed by the rise-time versus lead-length rule. A practical example here would be a wire no more than 15-inches long, loaded with fewer than four gates. To prevent objectionable ringing, however, a ferrite bead must be placed at the end of the wire. To improve the signal somewhat, a 100- or 120-ohm resistor can be placed at the line ending and returned to the V_{TT} source. That resistance more or less matches the impedance of the line and thereby reduces some of the overshoot.

An open lead, unfortunately, is prone to pick up noise along the way, making it undesirable for many applications (particularly clocking pulses). A better approach is to make interconnections with coaxial cable. Not only does the

continued on page 90

Voice-Operated Switch for your Tape

WITH ONE HAND YOU DELICATELY BALANCE the tip of your scope probe on the tiny pin of an IC while your other hand fiddles with the scope's sync knob. Suddenly, the long-sought-after trace shows itself in all its detailed glory! Now you can see the rise time, the overshoot, the pulse width, the DC level and all the other data needed to get the job done. But now what do you do? The notebook is across the room and you'll never remember all those precious numbers if you go get it.

You could dictate the readings to your secretary—if you had one. You could also lock the trace in your storage scope—if you had one. There has to be a better way. Let's see, your hands are full so you can't write—but you can talk! What's needed is cheap, hands-off recording gadget that would only record when spoken to, and would shut down during those long periods of utter silence when you are completely baffled by the peculiarities of your designs.

The answer is a voice-operated switch for a cassette tape recorder built from parts from your junkbox!

That is actually how the project came about. There was a real need to improve

BUILD THIS



JAMES P. REED

If you've ever found your hands "tied" when you needed to record an important piece of data, you'll appreciate the usefulness of this simple device.

Recorder

efficiency while doing design work and troubleshooting; in those instances stopping to write down data is usually inefficient or impossible. After a little reflection, it's easy to see that a voice-operated switch could be useful in a number of other situations such as taking verbal notes while studying, unattended monitoring of CB or ham receivers, etc.

For about \$20.00, providing you have a well-stocked junkbox, you can build a voice-activated switch that will detect speech and turn a recorder on in response to it. It will also turn the recorder off in response to periods of silence that last over three seconds. That three-second interval is provided to allow for the pauses in normal speech.

No modification of the recorder or its microphone is required. The voice-operated switch simply takes the place of the ON-OFF switch found on most recorder's mikes.

Operating the device is quite simple. Simply plug the cassette recorder's microphone into the jacks on the automatic switch's front panel, set the microphone's ON-OFF switch to the OFF position, plug the automatic switch's cable

into the recorder, and set the recorder up to RECORD. The only other thing you need to do is to set the switch's RANGE control so that it will be triggered by your speech, but not by random noises. At highest sensitivity the author's unit would trigger on noises as far as 10 feet from the mike.

Due to the start-up time of the tape transport, sometimes the first syllable of a message may be lost. That does not usually cause any serious problems, but if it bothers you, preface your comments with something like "hey" or some nonsense syllable.

Circuit operation

The device, whose schematic is shown in Fig. 1, is designed around a LM324N quad op-amp. Housed in a 14-pin package, that op-amp requires but one supply voltage and is especially useful for battery-powered circuits.

One of the op-amps in the device (IC1-a) is configured as a very high-gain amplifier. With the values shown for R1 and R3, the gain of the amplifier is about 1000. Capacitor C1 couples the audio signal to the op-amp's inverting input while blocking any DC that might be present at the recorder's mike input. Resistors R2 and R4 bias the non-inverting input so that the DC output of the op-amp is set to approximately $\frac{1}{2}$ of the supply voltage. Capacitor C2 bypasses any AC that might appear at the inverting input. That is im-

portant here due to the extremely high-gain of the amplifier. If it were not done, AC signals at the inverting input of IC1-b would show up in the amplifier's output and cause oscillation.

The amplified audio signal is coupled to the second stage through C3 and is applied to the inverting input of IC1-b. Resistors R6 and R10 bias that stage so that, with no signal input, the output from the amplifier is zero. Resistors R5 and R9, and potentiometer R8, allow us to set a DC voltage at the non-inverting input to which the audio signal at the inverting input can be compared.

The biasing of IC1-b is arranged so that only the negative-going half-cycles of the audio signal are detected. By adjusting the RANGE control (R8), we can set the detection level of the amplifier. Resistor R7 is used to limit the gain of that stage.

The presence of an audio signal produces positive pulse-like signals at the output of IC1-b that are coupled through R11 to the base of Q1. The collector of that transistor is tied to a time-constant circuit formed by R13 and C4. When Q1 conducts due to the signal from IC1-b, C4 is discharged through D1 and the transistor. That causes the inverting input of IC1-c to go more negative than the non-inverting input (the positive input of IC1-c is held at a reference level by resistors R14 and R15) and the amplifier's output goes positive. That positive output op-

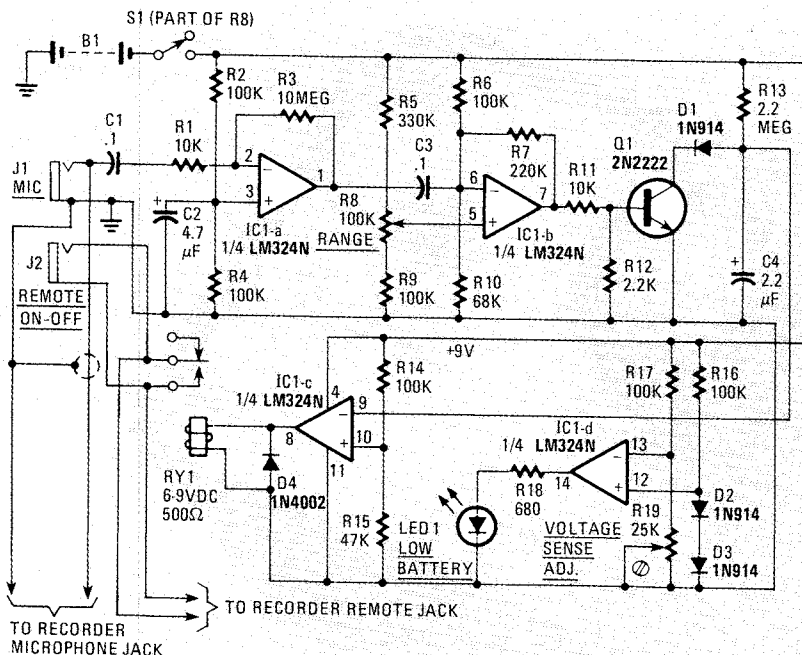


FIG. 1—A VOICE-ACTIVATED SWITCH. This simple circuit is capable of turning a device such as a tape recorder on and off in response to your voice.



FIG. 2—THE PROJECT IS HOUSED in a small project box with an aluminum front panel. Note the lead to the recorder at the right; it was taken from a defective microphone (see text).

erates relay RY1 and it's contacts close, turning the recorder on. Diode D4 protects the amplifier's output stage from being damaged by inductive kickback when the relay coil is de-energized. As long as audio signals are being detected, Q1 continues to discharge C4 and the relay is held in.

If no audio signals are detected by IC1-b, the R-C time-constant circuit charges up and the voltage at the inverting input to IC1-c goes more positive than the reference input. That drives the output to zero, de-energizing RY1 and turning the recorder off. With the values used in the

PARTS LIST

All resistors 1/4-watt, 5%, unless otherwise specified

R1, R11—10,000 ohms
R2, R4, R6, R9, R14, R16, R17—100,000 ohms
R3—10 megohms
R5—330,000 ohms
R7—220,000 ohms
R8—100,000 ohms, potentiometer, audio taper
R10—68,000 ohms
R12—2200 ohms
R13—2.2 megohms
R15—47,000 ohms
R18—680 ohms
R19—25,000 ohms, trimmer potentiometer

Capacitors

C1, C3—0.1 μ F, 50 volts, ceramic disc
C2—4.7 μ F, 35 volts, electrolytic
C4—2.2 μ F, 35 volts, low-leakage electrolytic, Radio Shack 272-1420 or equivalent

Semiconductors

IC1—LM324N quad op-amp
Q1—2N2222 NPN transistor
D1-D3—1N914
D4—1N4002
LED1—Red LED with snap-in holder, Radio Shack 276-018 or equivalent
S1—SPDT switch (part of R8)
J1—miniature phone jack
J2—subminiature phone jack
RY1—miniature relay, 6-9 volts DC, 500 ohms, Radio Shack 275-004 or equivalent
B1—9-volt battery
Miscellaneous: Perforated construction board, project box, battery holder and clip, IC socket, wire, cable, solder, etc.

prototype, the delay is about 3 seconds.

The fourth op-amp, IC1-d, is used as a low-battery-voltage detector. Configured as a comparator, IC1-d will light an LED on the front panel when the battery voltage falls to a selectable limit (more on that in a moment). Taking advantage of the relatively constant voltage drop across a forward-biased diode, we develop our reference voltage via R16, D2, and D3. The reference voltage is applied to the non-inverting input of IC1-d while a portion of the battery voltage, as determined by voltage divider R17 and R19, is tied to the inverting input. When the battery has discharged enough to allow the inverting input to fall below the non-inverting (reference) input, the output of the op-amp goes positive and drives the LED on through current-limiting resistor R18. Resistor R19 allows us to adjust the trip point of the low-voltage detector; that point should be set at around 7.5-volts DC.

Construction

Building the switch should make a nice two-evening project. The author's unit

continued on page 99

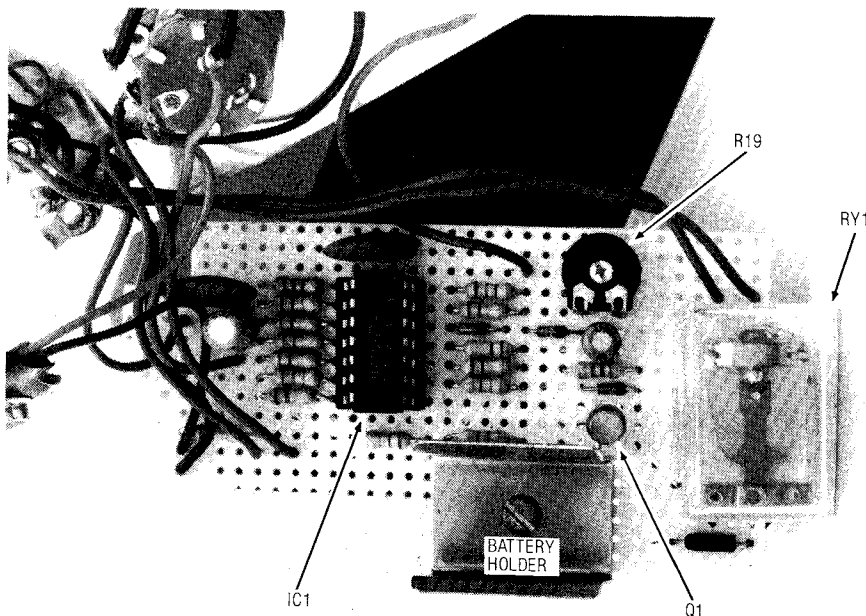
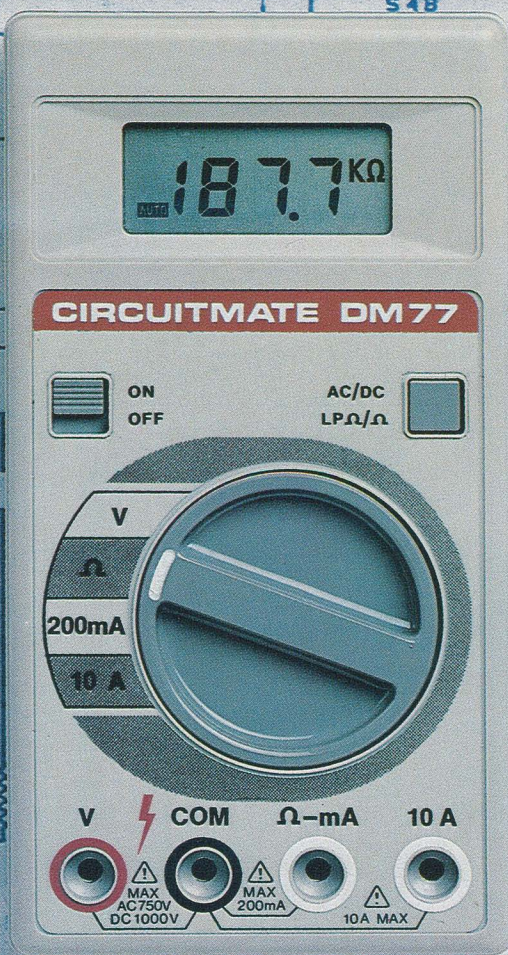
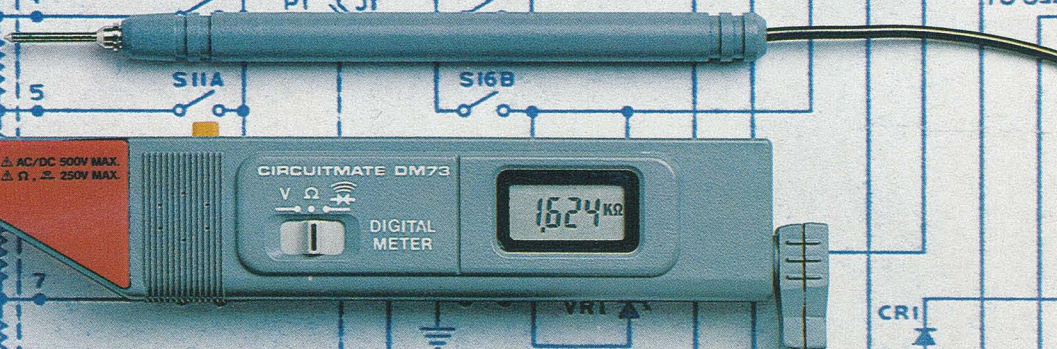


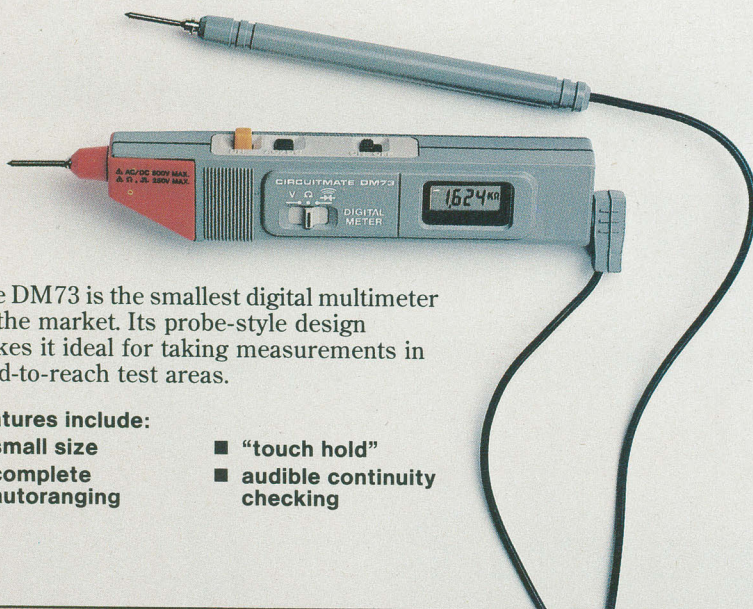
FIG. 3—MOST OF THE CIRCUIT can be mounted on a small piece of perforated construction board.

Beckman introduces two additions to its Circuitmate Family.



asked for at prices demanded.

\$72.95
(U.S. only)



The DM73 is the smallest digital multimeter on the market. Its probe-style design makes it ideal for taking measurements in hard-to-reach test areas.

Features include:

- small size
- complete autoranging
- "touch hold"
- audible continuity checking

\$64.95
(U.S. only)

When you need to make transistor gain checks, the DM20 is your best bet. This HFE meter is small in size, but big in features.

Features include:

- transistor gain tester
- dual voltage resistance test function
- conductance measurement capability
- 10 amps

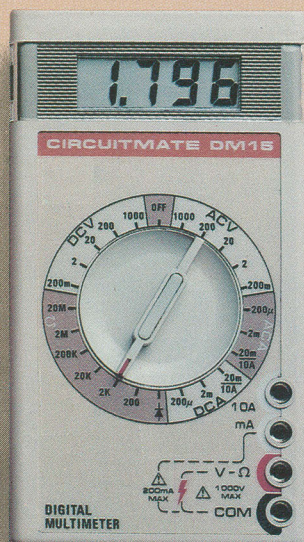


\$59.95
(U.S. only)

For just \$59.95, the pocket-sized DM15 offers you all the basics with 0.8% basic Vdc accuracy.

Features include:

- separate diode test function
- 10 amps
- 24 ranges



Beckman now offers you two more feature-packed Circuitmate™ DMMs for less than \$100. The DM73 and the DM77. Both meters offer you complete autoranging, plus the same high performance you can expect from all Circuitmate™ DMMs.

Feature Packed

The Beckman Circuitmate™ DMMs offer you a broad range of popular features. The line begins with an extremely low-cost, basic meter and spans up to a full-featured DMM with capacitance.

You can select such features as: dual voltage resistance ranges, conductance, autoranging, in-circuit resistance testing, audible continuity testing, and transistor gain checking.

Easy to Use

All Circuitmate™ DMMs are designed for maximum convenience and ease of use. The rotary dial makes selection simple and sure, while the bright display makes reading easy.

Special convenience features found only on certain models include: tilt bale, autoranging, "touch hold", easy-access battery hatch, and anti-skid pads.

BECKMAN

CIRCLE 10 ON FREE INFORMATION CARD

Features you've a you've de



\$89.95

(U.S. only)

The DM45 is a full-sized meter especially designed for your added convenience. It is particularly easy to work with.

Features include:

- audible continuity checking
- 10 amps
- recessed display window for long life
- recessed lead jacks for easy insertion and maximum safety
- tilt bail
- anti-skid pads



\$69.95

(U.S. only)

The full-sized DM40 offers you maximum convenience. Its tilt bail and anti-skid pads keep the meter steady for easy reading.

Features include:

- tilt bail
- anti-skid pads
- recessed jacks for easy insertion and maximum safety
- recessed display for long life
- separate diode test function



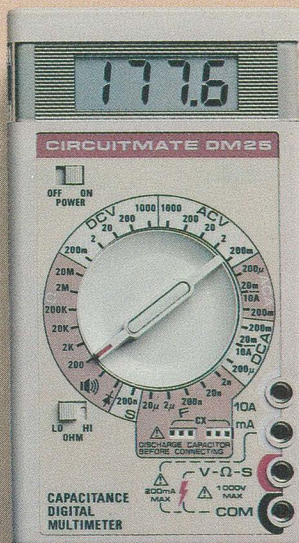
\$76.95

(U.S. only)

The DM77 gives you the convenience of autoranging plus 10 amps ac/dc measurement capability. You simply select the function you want, and the DM77 automatically sets the required range.

Features include:

- audible continuity checking
- dual voltage resistance ranges
- complete autoranging
- 0.5% basic Vdc accuracy
- 10 amps



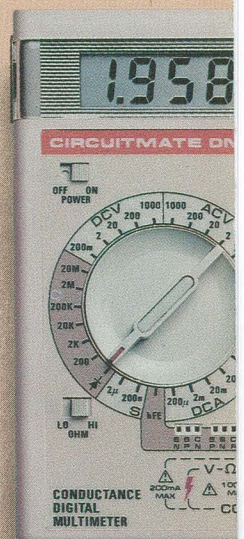
\$79.95

(U.S. only)

If you need to measure capacitance, the DM25 is the right Circuitmate™ for you.

Features include:

- capacitance
- pocket-size
- dual voltage resistance test function
- audible continuity checking
- separate diode test function



- separate diode test function

Circuitmate™ DMM Selection Chart.

CIRCUITMATE™	DC Volts Accuracy	DC Volts Ranges	AC Volts Ranges	DC Current Ranges	AC Current Ranges	Resistance Ranges	Diode Test	Continuity Beeper	Dual Voltage Resistance Ranges	Transistor Test	Conductance	Capacitance	Autoranging	Touch Hold	10 Amps	Size	Rotary Switch	Tilt Bail	Anti-Skid Pads	Recessed LCD Window	Recessed Jacks
DM15	.8%	5	5	4	4	6	✓								✓	POCKET	✓				
DM20	.8%	5	5	5	5	6	✓		✓	✓	✓				✓	POCKET	✓				
DM40	.8%	5	5	5	5	6	✓									FULL	✓	✓	✓	✓	✓
DM25	.5%	5	5	4	4	6	✓	✓	✓		✓	✓			✓	POCKET	✓				
DM45	.5%	5	5	6	6	6	✓	✓							✓	FULL	✓	✓	✓	✓	✓
DM73	.5%	4	4	N/A	N/A	4		✓					✓	✓		PROBE				✓	
DM77	.5%	5	4	2	2	5		✓	✓				✓		✓	FULL	✓			✓	

Easy to Select

With seven Circuitmate™ Series DMMs to choose from, there's one just right for you, and your pocketbook. To select the DMM that best satisfies your needs, check the Circuitmate™ Selection Chart.

For a closer look at the Circuitmate™ DMM of your choice, see your local Beckman Distributor. To find the one nearest you, call or write: Beckman Instruments, Inc., Electronic Technologies Group, 210 Ranger Ave., Brea, CA 92621. (714) 993-8852.

BECKMAN

mini player-piano

ROBERT GROSSBLATT

Build the Pianomatic and make beautiful music—electronically.

Part 3 This month we'll conclude our look at the pianomatic. Figure 17, the interconnection diagram that was discussed last time, appears on the following page.

The voltage regulator

Although voltage regulator IC13 is designed to output five volts, we can change that and make it provide 7.3 volts, a good operating voltage for the Pianomatic. By raising the ground terminal, pin 2 (C in Fig. 4, September issue) above system ground, we trick the regulator into putting out a higher voltage. Whenever you need a voltage slightly different than you can get from a standard series-regulator, that little trick can save you all sorts of design problems. Nothing is without a price, however. Certain circuit conditions, such as operating the regulator near the limit of its current capability, can cause the resistor at the ground terminal, R34 here, to overheat, change value, and change the regulated voltage. So make sure you heat-sink the regulator and use a resistor of the proper wattage.

The maximum current-draw of the Pianomatic is about 100 mA at 7.3 volts, so it's not unreasonable to use batteries as a power supply. Remember though, that the voltage regulator, IC13, is a series regulator, and is not anywhere near 100% efficient. Although it will provide a steady output voltage, it requires an input voltage at least 2.5 volts higher than the desired regulated output. In the case of the Pianomatic, some elementary arithmetic tells us that we need at least $7.3 + 2.5 = 9.8$ volts for B1-B8. Eight alkaline cells provide us with $1.5 \times 8 =$



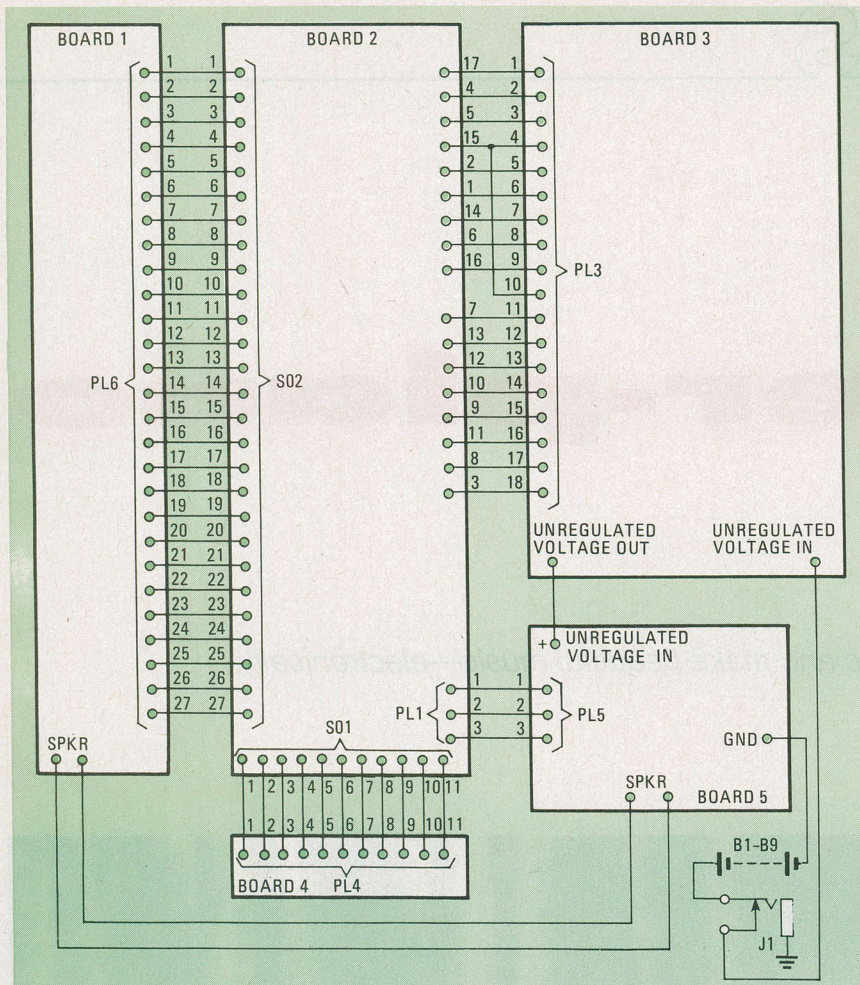


FIG. 17—HOW THE FIVE boards are interconnected. The connections between Boards 2 and 3 are also listed in Table 2.

12 volts nominally, and are a good choice. Since the current required is a maximum of 100 mA, "AA"-size cells

are the smallest you should use. The inclusion of J1 in the circuit also makes it possible to power the Pianomatic from an

external source such as a wall-plug transformer with a DC output.

If you decide to make a little nickel-cadmium pack for B9-B11, it's a great help to get button cells, or whatever, with solder lugs on them. Solder the cells together in series and then cover the package with a piece of heat-shrink tubing of the proper size as shown in Fig. 18. The PC pattern has space for three button cells with small pigtails of wire at the end to connect them to the board. If you use different cells, other provisions for mounting them will have to be made.

Troubleshooting

In a system as complex as the Pianomatic, there are no simple ways to troubleshoot the circuit. If you make PC boards using the foil patterns provided, you won't have any electronic problems. Check for all the usual things—look for broken traces, unetched copper between the traces, bad solder joints or solder bridges, etc. If you suspect an electronic problem, do all the standard tests—are the clocks clocking, have I overlooked something incredibly basic, have I forgotten to apply power to the circuit, and so on. Check the polarities of the diodes and IC's against the placement diagrams. The last thing to check, the very last thing, are the IC's. Chances are that if an IC hasn't committed suicide and fried, there's nothing wrong with it. Wayward operation of an electronic circuit is usually due to a normal IC being fed schizophrenic data and doing its best to cope.

The connectors from board to board are male and female header strips made by AP, Sprague, and others. They come with standard 0.1-inch spacing, can be cut to any length you want, and are nice and cheap. One other nice thing about them is that they don't have to be mounted right on the edge of the board. That is a real advantage because digital boards are often topological nightmares. The male headers come either straight or right-angled, and both types are used in the construction of the Pianomatic. If you're really into saving money or don't ever expect to take the boards apart, you could hard-wire the boards together, but that is really a false saving. If you do use the connectors, be aware that they can be put

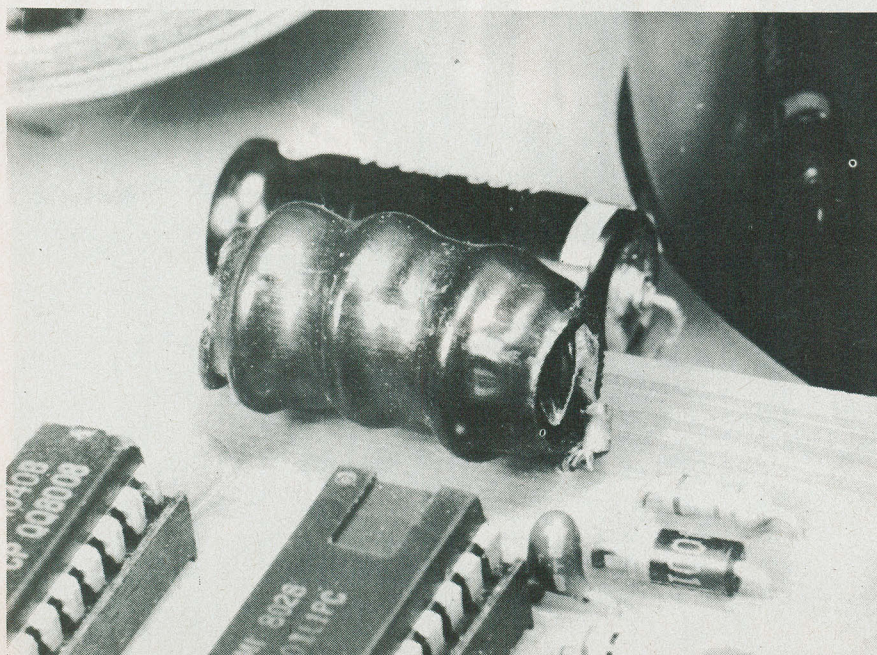


FIG. 18—BATTERIES B9-B11 should be button-cell types with solder lugs. Those batteries can then be soldered together, covered with heat-shrink tubing, and mounted directly on board 1 as shown.



FIG. 19—FOIL PATTERN FOR HEADER STRIPS. The length of the board can be made as long or short as needed.

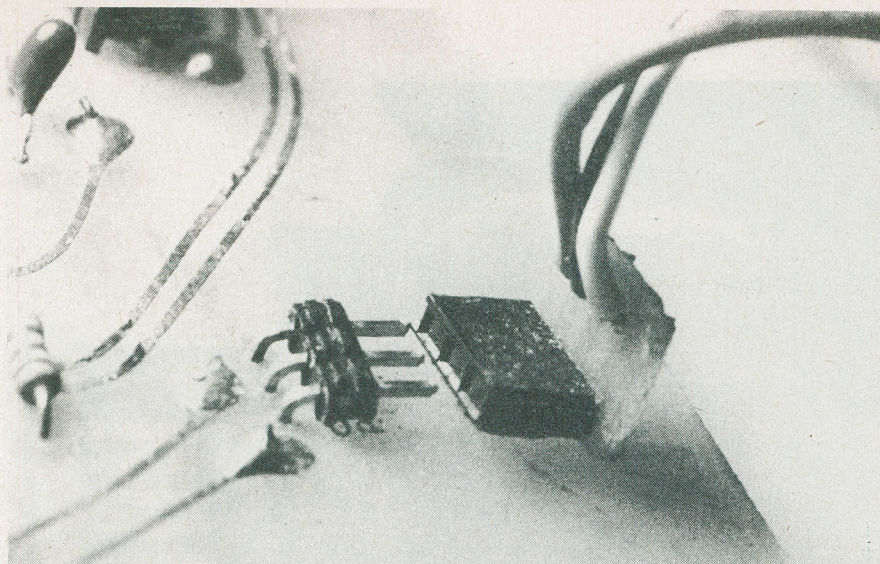


FIG. 20—A SHORT HEADER STRIP is shown here. This is one of the power interconnections.

at the end of a length of multi-conductor cable by making a small circuit board for them. A foil pattern for that is shown in Fig. 19 and you can see the construction in Fig. 20. The PC board can be made as long as you want depending on your need, and comes in handy when you have to deal with an oddball number of connections.

Calibration

The only calibration needed by the Pianomatic is the setting of the low-battery-warning trip point. Connect the Pianomatic to a variable power supply set to about 12 volts. Verify that the output of the voltage regulator, IC13, is 7.3 volts. If it's not, you'll have to change the value of R34. Raising the value will raise the voltage, and vice versa. Once you have the correct regulated voltage, lower the input voltage to 9.8 volts. Adjust R41 until the decimal points light in the display. If your decimal points lit when you supplied the twelve volts, disconnect the power and move the wiper of R41 closer to ground. When you turn the power back on, the decimal points will be out and you can then calibrate the trip point of the circuit.

One point about those displays. You'll note that they have 10 pins, but that there are only 9 mounting pads on the PC board for each. The reason for that is that pin 1 is a second common-cathode connection and is not needed. Thus, that pin can be unused without affecting operation. To keep things simple, it is cut off, eliminating the need for one of the mounting pads.

Use

The Pianomatic is very easy to use. With the control switches set to WRITE, MANUAL, and MEMORY, the display counter should be all zeros. Every time you press a key, you will hear the correspond-

ing note and the LED in the key will light. When you release the key, the display counter will increment by one to show you which note position you are programming next and the LED corresponding to the next note in memory will light up. If you make a mistake in programming, don't worry because the Pianomatic is very easy to correct later on. After you've programmed the entire tune, push the RESET button, S6, to get back to the beginning of the page. Put the READ/WRITE switch, S2, in the READ position, and single step through the tune in MANUAL playback. If you come across an error, put S2 in WRITE and program the correct note—that's all there is to it.

There are 16 switches on the keyboard. Switches S10–S22 are used to program notes. To program a rest, S9 is used. Switch S23 is used to program a half rest (binary 14). Finally, S24 is used to enter a binary 15 (tune end) on the bus.

It's a good idea to program in a rest for the first note in a tune (the note that occupies the position shown in the note-counter display as 000), since the Pianomatic will automatically reset to that position when you are playing back a tune in AUTOMATIC. Remember that the last thing you have to program in a tune is a binary 15 (tune end). The Pianomatic will decode that and stop playing.

The Pianomatic doesn't understand the difference between a quarter, half, or whole note. If the tune you are programming requires a note to be held for three beats, you'll have to program it in three successive addresses in the memory. Although you will be playing back three notes, the transition between them is so smooth that you won't hear any interruption. Likewise, because of that smooth transition, if you want a fresh attack on a note, you'll have to program in a half rest (binary 14) before it.

The blanking of the displays and the counter resetting is handled automatically

by the circuitry in the Pianomatic. If you feel that you want to change any of it, you'll have to rewire some of the switches (for the display blanking), or remove some components (for resetting the counters). For instance, the Pianomatic resets the counters to zero when you switch from WRITE to READ. If you wanted to defeat that you would have to remove D2 and C6. If you find that you want to eliminate any of the automatic control functions of the Pianomatic, study the schematic, locate the relevant parts, and take them off the board.

Table 1 (in the September issue) describes the control functions of the switches and gives you a good idea how to go about changing anything you want. Remember that none of those functions are sacrosanct. The circuit and its operation are interesting enough to teach you a lot of things if you're willing to spend the time playing "What if?"

Before you go about changing things, however, make sure your Pianomatic is working, and that you understand the information in Table 1. The effects of the switches are all interrelated and putting the Pianomatic in any particular mode of operation may require the throwing of several switches. As you can see from Table 1, the keyboard is disabled in AUTOMATIC playback. This means that if you want to use the keyboard, switch S3 must be in the MANUAL position. That is true regardless of how the other switches are set. The same sort of reasoning applies to the other functions of the Pianomatic. If you go over Table 1—carefully—you'll see what has to be done to change any of those things.

Case

A plastic piano-shaped case was built for the Pianomatic; the control switches (board 3) were located in the bench and B1–B8 were located in the wood box on which everything else was mounted (see Fig. 21). Obviously that isn't necessary—the Pianomatic can be put in any standard box large enough to accommodate the boards, batteries, etc. If you decide to make a fancy case for your Pianomatic, or even just a piano-like keyboard, here is some straight-from-the-shoulder advice—try to find a toy electronic piano that has a keyboard of the right size, cannibalize the toy, and use the keyboard. The prototype was built using microswitches for switches S9–S24, and it was an extraordinary amount of work. If you use a toy piano, the only alteration you'll probably have to make is to drill the holes in the keys for the LED's.

As you can see from the foil pattern for Board 5 (Fig. 11), the board was designed to fit in the rear of the piano-shaped case. The speaker was mounted on the rear of the board and small lengths of wire were used to connect it to the speaker terminals on Board 1. If you decide to go that route, drill a hole in the rear of Board 5 and

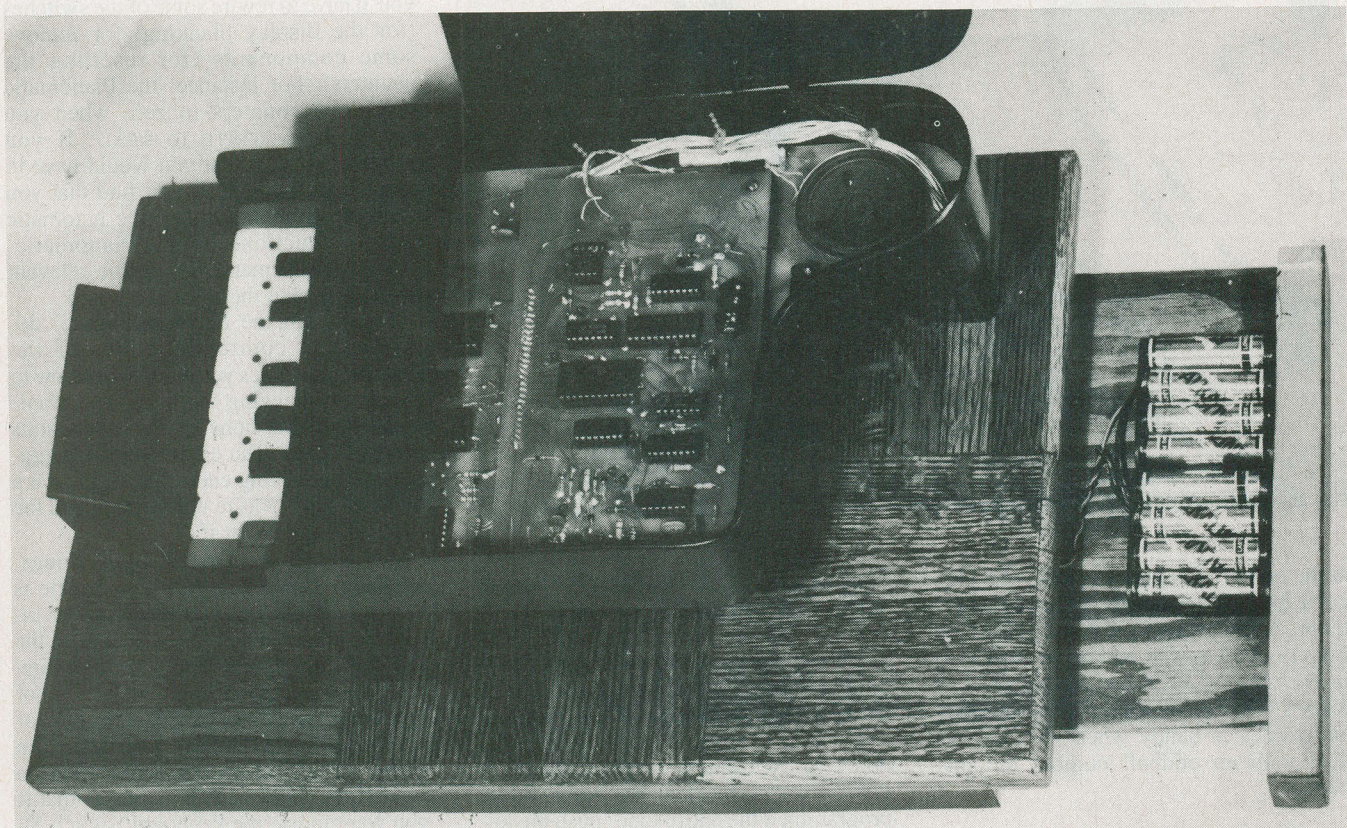


FIG. 21—THE COMPLETED PIANOMATIC. The “piano” case and “bench” were mounted on a wood base in the author’s prototype shown here.

slowly enlarge it until the speaker’s magnet housing fits snugly in the hole.

The note-counter display board, Board 4, is laid out so that the display digits will sit in the middle of the keyboard. Right-angled male headers on Board 4 are used as the connectors and the entire board plugs into the appropriate strip of female headers on Board 2.

Just as an aside, some of you might wonder why a 4514 was used for IC1 and a 4515 for IC6. The difference between them is only in the polarity of their outputs—otherwise they’re pin-for-pin identical. The answer is very simple—one of each was on hand so they were used. The reason had more to do with inertia than anything else.

Expansion

The Pianomatic is designed to play a total of 256 notes, and only one note at a time. If you want to expand on those things, you’ll have to expand the memory. If you want longer tunes, you’ll have to have a memory that can handle more words. If you want to increase the range of the Pianomatic you’re going to have to increase the amount of data in each word—you’ll need a wider bus.

One extra bit on the data bus will enable you to insert a programmable divide-by-two network between the note generator and its clock. By doing that you can add an entire octave to the range of the

Pianomatic—two extra bits and you’ll get four octaves, and so on. All that’s necessary to shift an octave is to divide the frequency going into the clock input of IC7. If you want to be able to play more than one note at a time, you’re going to need a separate bit for each note in the octave. That means you’ll need a data bus at least thirteen bits wide—a sixteen-bit bus would give you all the notes playing individually, four or more octaves, and still leave room for programmable voicing, tremolo, and so on. The only change you’ll have to make in the circuitry, other than the memory, is to have a separate 50240 for each octave and a separate analog switch for each note. The last word of caution is to remember that the outputs of the note generator, IC7, cannot be connected directly together. You will have to sum them with resistors and then feed the common legs of the resistors to the input of the amplifier.

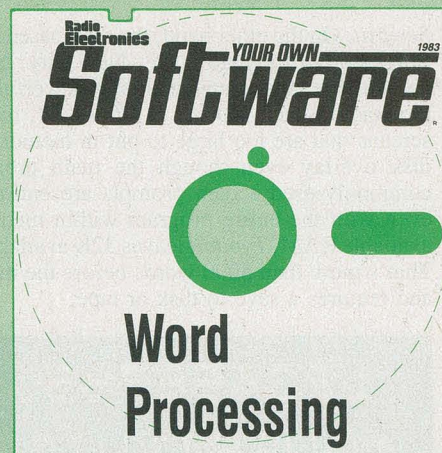
Although the Pianomatic was designed as a programmable music box, it can be used as a doorbell, alarm, telephone ringer, or anything else you can think of. By replacing the START switch, S4, with a small relay, just about any type of signal can make it play. A little bit of ingenuity on your part will easily produce a substitute for the tune selector so that different signals (doorbells on different doors, for example) will trigger different tunes. The range of applications is limitless.

A set of the five PC boards, etched and drilled, but not plated through, is available from Hal-Tronix, PO Box 1101, Southgate, MI 48195. The price is \$39.95. Please add \$2.00 for shipping and handling. MI residents add 4% tax.

Any construction project should also serve as a learning experience, and the Pianomatic has a lot to teach you. It uses circuit techniques that can be adopted for your own designs. It should make you think of variations in applying the principles of operation so your own projects become more and more sophisticated. Low-power memory retention and keyboard encoding are only a few of the things you can learn by understanding the operation of the Pianomatic. **R-E**



“There’s something wrong with this digital readout. It’s nothing but a bunch of numbers.”



A user's first software purchase is often a word-processing program. Confused? We'll help you out.

Word Processing

HERB FRIEDMAN

NO ONE HAS REALLY COUNTED, BUT THERE IS PROBABLY MORE word-processing software for personal computers than any other kind of non-game program. And for good reason. Because once you get away from the classroom, the educators, and the "computer schools"—all of whom push BASIC programming as computer literacy—most personal computers are used to do things: to prepare letters, documents and reports; keep records; process mailing lists; handle bookkeeping; plot the stock market, any of a thousand things. None of these require a knowledge of programming because the software you need already exists and is generally available...at the very least, for the most popular computer systems.

Since much of what you do with your computer will eventually end up in some form of report or document, word-processing software is one of the first serious software purchases.

Another reason for the importance of word-processing software is that much of the budget-priced software for low-cost desktop computers works through the word-processing environment.

Now "word-processing environment" is a mouthful that we should explain before we go any farther. There are two aspects to the word-processing environment. First, it is often used to hold down the cost of other software. For example, a lot of the time spent developing and debugging database software—which simply means electronic files or a mailing list—goes into allowing the user to enter the desired data in simple English words or phrases. If the user can use his existing word-processing software to prepare the database records, a good part of the database's development time and effort is eliminated. The database that might have cost, perhaps, \$150, can be sold for \$80, or \$60 or less. In this instance the database comes with a patch that automatically modifies the user's word-processing software so it can be used to prepare the database records. This is called "using the existing word-processing environment." When the user must prepare data records he calls up the specially

modified version of the word processor.

The second aspect of the word-processing environment modifies what is already an integrated database package to work with some other—commonly used—software, usually a word processor. For example, *MicroMailer* or *MicroVenture*, one of the finest low-cost mailing list systems, can modify itself so its mailing list records can be integrated into the *MailMerge* (MicroPro, 33 San Pablo Ave., San Rafael, CA 94903) program that runs under *WordStar* (MicroPro). This might not seem earth-shaking at the moment, but if you have to prepare form letters using the *WordStar* word-processing program, it's a lot easier to integrate *MicroMailer's* address files than to retype the whole thing in *WordStar* format.

In both of these examples, the cost of the software or the user's time and effort is reduced by making it a part of the word-processing environment. The savings in time and money are substantial—easily \$100 or more in software costs—so it's easy to understand the importance of the word processor, and why it is so popular.

In and out of memory

There are two basic forms of word processors: In Memory and Disk Overlay. An in-memory word-processor is always entirely within the computer's memory and includes the printer driver. That's the software routine that outputs the created document or text to the printer. Whatever RAM is not used by the software (which includes the driver) is available for text storage. In-memory word-processor software can originate from tape or disk. It makes no difference because a mirror-image of the software on the tape or disk is created in memory. Once the program and printer driver are in memory the storage media isn't important. For example, the superb *Telewriter-64* (Cognitec, 704 Nob Ave., Del Mar, CA 92014) software that converts the Radio Shack *Color Computer* into a professional-quality word-processor, is supplied on tape or disk, as is Radio Shack's own

Scriptsit. On the other hand, the disk-based *Typitall*, from Howe Software (14 Lexington Rd., New City, NY 10956), which is perhaps the most convenient and powerful word processor for the Radio Shack *Models I, III, and 4*, has extensive "help" screens that are too large to put in memory. They remain as a disk overlay even though the main program itself and the commonly-used screen prompts are entirely in-memory. Yet even with the entire program within memory, out of 48K of available RAM, *Typitall* leaves 32K available for the document. That's more than 5000 words before the memory becomes full and requires a save to disk or tape.



TYPITALL'S HELP SCREEN shows you a representation of the keyboard that shows control and function keys and special characters.

One major advantage of the in-memory software is that it will instantly reformat the text displayed on the screen. Also, it easily accommodates different printers because you can have several versions of the software on the same tape or disk. Since the printer driver is independent, an in-memory word-processor easily accommodates several printers without the need for manual patching of the program for each printer. This probably sounds confusing so let's untangle it by giving a specific example.

Imagine that you have a high-speed matrix line printer for general use and a daisy-wheel printer for letter-quality documents. It is more than likely they use different commands for the underscore. For example, the Epson printer might take a special software routine for an underscore that is activated with a control-U, while a Smith-Corona *TP-1* daisy-wheel requires the "EM" command to turn the underscore on and off. If you use an in-memory word-processor such as *Typitall*, you prepare two versions, one with the key you select to represent the underscore command providing the correct command for the Epson, another with the key representing the "EM" command for the *TP-1*. Now it doesn't matter which version you use to prepare the document. When you decide to print, you load the version for a particular printer and the software automatically corrects the underscore command to the correct sequence for the printer. This is a tremendous convenience that can only be appreciated if you normally use two or more different printers. I use three printers, an Epson, a *TP-1*, and an IBM *Selectric*. My document can be printed by any of the three by simply loading the desired version of *Typitall*. I don't have to go through the hassle of correcting the printer codes within the document or patching each document for a specific printer.

Keep in mind, however, that not all in-memory word-processor software permits easy interchange of printer drivers. Radio Shack's own *Scriptsit* has no provisions at all for different printers. Only specially-modified versions of *Scriptsit*, using third-party software, provides the underscore and additional printer drivers for *Scriptsit*.

Another unsung advantage of in-memory software is that you can often print the work you have created, or just part of it, before it's stored. You get a chance to see how it will be formatted by the printer. If you don't like how it looks you can

either revise the document or instantly reformat the text. (In-memory software, however, doesn't let you see how the printed output will appear on the screen—you have to print it out. We'll see shortly that some disk-overlay software does.)

For example, you set the screen width so it exactly conforms to the selected printer width. You look at the display and you don't like it. You are set for 60-column width and you will end up printing a double spaced document in 26 lines; 25 lines on Page 1, and one line on Page 2. You want it all on one page; so you set your screen width for 63 columns and instantly the screen reformats. Now you find this produces 25 lines on Page 1, and one single word on Page 2. So you reformat again, to 64 columns wide, and zap, everything fits on 25 lines. Great! Just what you wanted! You set the printer format for 64 columns and what you see is what you get—25 lines on one page.

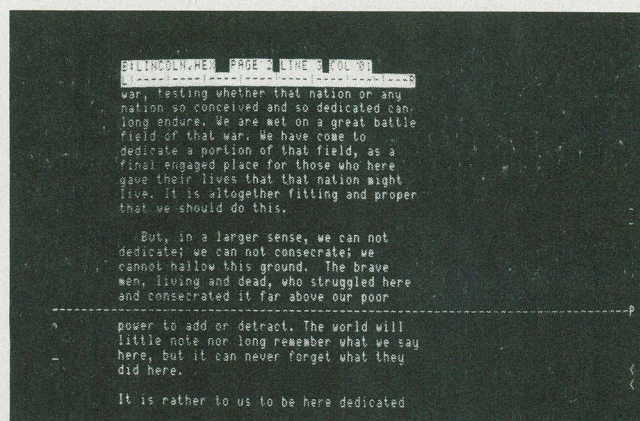
But you still don't care for the way it looks. So you touch a couple of keys and the screen format changes to 64 columns justified; meaning straight left and right margins. Aha! That looks even better, so you set the printer driver for 64 columns justified, and you print what you see.

Now virtually all decent word-processor software will reformat on the screen, but not instantly. Of the major word-processor software, only the in-memory systems are instantaneous—the others take a lot of fussing, particularly if you then use a spelling checker or dictionary.

Before we leave in-memory formatting, keep in mind that only the screen width is usually accurate. I'm assuming you have a "commercial-width" screen, which means 64 columns minimum, preferably 80 column. Anything less than 64 columns causes more problems than it's worth so we will not even consider anything less than 64 columns. So how come we mentioned the Radio Shack's *Color Computer*, with its 32-column screen? Because *Telewriter-64* generates a 64-column screen by creating characters with graphics. (Must be seen to be believed.) While the column width is displayed accurately, few programs show precisely how the printed page will appear with multiple line spacing. Even *Typitall* forces the user out of the create (edit) mode into a special viewing mode to check how the hardcopy will format. Most in-memory systems don't even permit this.

In-memory queuing

A major limitation of the in-memory software is the way it integrates pre-written blocks of text. Assume you have prepared four stock paragraphs that you will use for "boilerplating"; meaning, you create a document using "stock" blocks (paragraphs) of text that have been saved on a cassette tape or floppy disk. You have created a document using blocks No. 3 and 1, and you decide to plug block No. 2 in between blocks 3 and 1. This usually can't be done. In-memory systems, chain (append) blocks at the end of the document being prepared. In other words, block 2 will chain in after block 1. But once it's in (on the screen) you will have to use a block move (or paragraph move) command to move block 2 into position between blocks 3 and 1.



A PAGE BREAK is indicated by a dashed line in *WordStar*. At the top of the screen, the page, line, and column numbers are indicated.

It sounds easy enough, but it gets out of hand when you're moving several blocks into a rather large document—you tend to lose track of what is moving where.

The general rule of thumb for blocks and in-memory word-processing is: if the blocks are already in memory you can move them around in any order with almost lightning speed. If the blocks are being read in from disk or tape they chain to the end of the working document...then you can move them around in any order.

Disk overlay

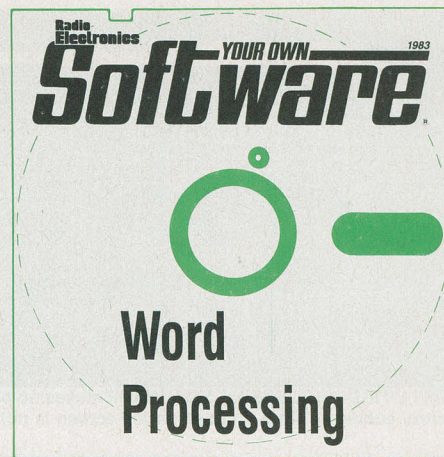
The most complex and therefore the most powerful word-processors—of which *WordStar* is the best known—are so large that the entire program is rarely in memory because it would either exceed the memory of a 64K RAM computer, or the amount of free RAM would be too small to store complete multi-page documents. To free up as much RAM as possible, the software routines that are used infrequently and the “help” prompts are not moved from disk to RAM, they are called into RAM only when needed. Also, the printer routine often resides on the disk—not in RAM—as a separate program, making it impossible to produce an instantaneous hardcopy of the working document.

For example, assume you have created a document that is a nasty letter to the local utility. You open with “Dear Rat Finks:”. Somehow, you don't believe this will look good on paper and you would like to make a quick print. No way! *WordStar* and many other similar programs cannot easily make a print of a document, or a partial document until it has been saved on disk. Then the printer routine is called up and it uses the disk file to make a hardcopy. (Sometimes you can just scream in frustration.)

If hardcopy is possible only from documents already stored as disk files, it follows that if you store the document on disk but leave it on-screen and make further additions and changes to the screen version, a PRINT command will make a copy of the version on disk, not the version in the computer. Again the new version must be saved and then printed. (Yes, you again scream in frustration.)

One disadvantage of disk-overlay word-processing programs is that they are often slow—sometimes intolerably so. However, using a memory disk (RAM configured as a disk drive), speeds things up considerably.

Though disk overlay word-processors tend to have some unusual characteristics, they most closely approximate the dedicated word processors. A dedicated word processor such as a Lanier, a Wang, IBM, Xerox, or whatever, is made to do one job: prepare documents. To this end they are jam-packed with string-handling features. They will align decimals in columns of numbers and then stack the columns side by side. They allow the user to call in a reference document for on-screen comparisons or evaluations. They can call up a spelling checker or dictionary from within the word-processing program. And in particular, dedicated machines usually have separate, well-labeled keys for



the most-used functions, such as DELETE, INSERT, LINE DELETE, BLOCK MOVE, EXECUTE, PRINT, etc.

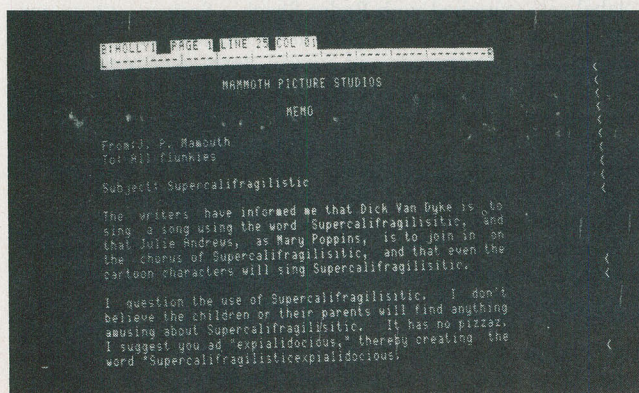
In general, the word-processing software for microcomputers only approximate the most important features of a dedicated word-processor machine. Essentially, we end up with a computer trying to function like a word processor. A really good word-processor program for microcomputers, such as *WordStar*, does a rather thorough approximation of a dedicated word processor. There are other word-processor programs that are also effective, but they don't do quite as thorough an approximation as *WordStar*.

In terms of professional features, *WordStar* is the one to which all others are compared, even by *WordStar*'s own competitors. Well...at least this is true for 8-bit machines where 64K of RAM is the general rule. *WordStar* is memory-efficient, and through the use of disk overlays packs a lot of features into 64K of RAM. With the new 16-bit machines the programmers have lots of memory to literally waste, and there is advance information to the effect that some new 16-bit word-processors will actually out-perform *WordStar*. But this is comparing apples (8-bit) with oranges (16-bit). What happens when *WordStar* gets completely re-written for 16-bits?

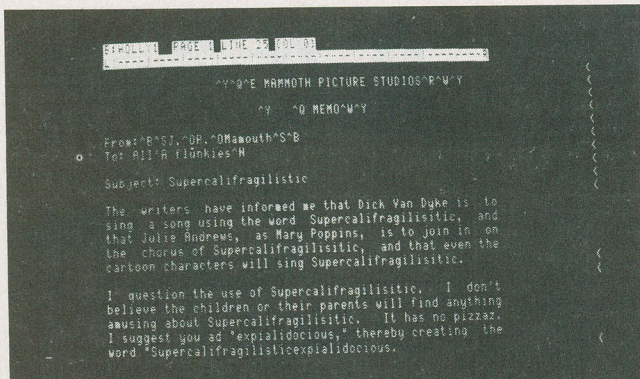
It is true that *WordStar* is a bit of a pain, particularly if it's not used every day. It has 149 direct commands, and with one or two exceptions none have any logical order. For example, in most systems the letter “D” represents DELETE. In *WordStar* it's the letter “Y”. While either “I” or “V” is usually used for INSERT, *WordStar* uses “V” for insert under one condition, and as part of the command for a movement of the cursor under another condition. But more important, *WordStar* does not have automatic formatting. If you change the line width you must reformat each and every paragraph. If you have formatted and then found a misspelled word that was short a few letters, inserting the letters destroys the format for that line, and the user must manually reformat the line. In another powerful type of overlay word-processor, such as *Peachtext* (Peachtree Software Inc., 3445 Peachtree Rd., N.E., 8th Floor, Atlanta, GA 30326), inserting extra characters would automatically produce a reformat to maintain the user-established line width.

Part of *WordStar*'s formatting deficiency (if it can be called a deficiency) is caused by its absolutely accurate screen representation of the final printout—and only *WordStar* among the better-known, high-performance programs has this accuracy. A *WordStar* screen display can be user-set to precisely represent the printout, including multi-line spacing and the page break, which is a dashed horizontal line across the page. An information line across the top of the screen always indicates the page number being viewed.

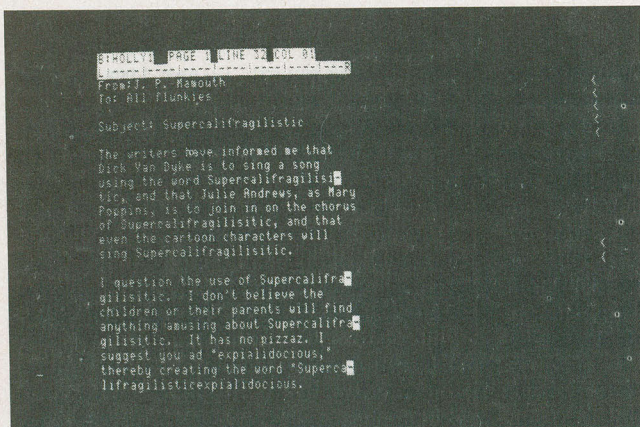
It is difficult to understand the importance of a precise screen representation of the printout if you have never had need for it. As a magazine writer, I generally have no use for it. The instant automatic format, advanced insert and overwrite and multi-printer driver features of *Typitall* are more important to me when



WORSTAR SHOWS ON SCREEN exactly how a document will appear when it is printed out.



MOST WORD-PROCESSING SOFTWARE makes no provisions for hiding control codes, so what you see on the screen is not what is printed.



SOFT HYPHENS or ghost hyphens are used to indicate possible word breaks. If the text is reformatted, the words are restored if possible.

preparing an article. But when I am creating a document that requires precise positioning of columnar material, or preparing advanced "boilerplating" where I must combine single and double line spacing with multiple paragraph widths, there is simply no substitute for complete screen/prINTER formatting; it literally saves hours of work.

If you require precise, or even moderately accurate screen display of the printout, you must use a program that will conceal the printer control characters. If the printer control characters are displayed they throw the screen out of true orientation because each control character, which will not be printed, is shown on the screen.

But *WordStar*...again *WordStar*...can conceal the characters so the screen shows exactly how the document will print. As shown in the illustrations, the screen display of the control characters can be turned on and off at will.

Simply because *WordStar* is so commonly used—it is the de-facto standard for word-processor software. There are many third-party enhancements that either modify *WordStar*, or work in conjunction with *WordStar*. For example, *WordStar* accommodates only four user-programmed printer control codes. If you need more than four, or if you want to use any control code that the printer can handle, then you need an enhancement known as *HexPrintR* by C.I. Software. *HexPrintR* not only allows the user to send any printer code from within *WordStar*, it allows graphic creations if an Epson *MX-80* type printer is used. (You can print those cute "Have A Nice Day" faces.).

Then there's an enhancement called *Math* from *Force Two, Ltd.* It imbeds a four-function calculator mode within *WordStar*. If you list a column of numbers, *Math* will automatically add the column if desired, just as it will do subtraction, multiplication and division.

Into heavy textbook preparation, or preparing a college thesis for one of those stuffy professors to whom style is more important than content? Then you might want the enhancement called

Footnote from *Pro/Tem* that does exactly what it says...prepares footnotes for documents.

Do you need an index or table of contents for a *WordStar*-prepared document? You could muck your way through all the references and compile the information by hand, but another enhancement, called *Documate/Plus* from the Orthocode Corp. (1435 Twenty Second Ave., San Francisco, CA 94122) will create it for you from a *WordStar* prepared document.

It is unfortunate that this is beginning to sound like a plug for *WordStar* because that is not the intention. (I, for one, prefer to use an in-memory processor for general use because of its speed-of-response). The simple truth is that *WordStar* has so many features that it is the one to which others are compared, and the one for which enhancements are usually written first, and the one for which accessory programs, such as low-cost but very effective data bases, are usually written first. (And this will probably bring in at least 50 letters detailing numerous exceptions.)

Keep in mind that every word processor is certain to be hailed as "...another breakthrough in the state of the programming art;" or crowned as "...the leading word-processing software for the year 19xx" (you fill in the x's). Regardless of which word-processor software you're interested in and regardless of its cost, if it doesn't have the most-needed very specific functions you want, you will never be satisfied (and replacement word-processing software usually doesn't come cheap).

It is a general rule of thumb when selecting a word processor that you look for the things it doesn't have. All have character and word insert, all have overwrite, all have some form of a block move, and all have a hundred other "state of the art" features. But does it have what you truly need? If you run a service or parts business where you must prepare bids and quotes on many different items, "boilerplating" from pre-written, "stock" paragraphs is one of the very most important features. If you run a small service business using the mails for direct advertising, does the word processor integrate easily with your present multi-selector mailing list software? If you are a student, does the word processor support the superscripts needed to mark footnotes? does it support footnotes? If you publish a newsletter, does it support columnar screen and printer formats (side-by-side columns)? If you're into *VisiCalc* and *SuperCalc* spreadsheets, does the word processor integrate them directly into your document? Most important of all, is the word processor easy to use? If you need frequent printouts from selected paragraphs, or the screen, or a line of text or a block, can you do it easily without getting tangled in relatively complex printing routines?

Consider how frequently you will use the word processor. Many have complex and confusing commands, that are no problem if you prepare documents daily—it's easy to remember what you use frequently. But if you do only occasional word-processing, remembering more than a hundred control codes can be a real problem, and you might end up spending most of your time thumbing through the manual trying to discover how to do things. Perhaps the best arrangement for infrequent users is the "label set" supplied with Radio Shack's *Scriptit*, which consists of a set of self-adhering labels that affix to the front of the keys used for commands and control. Instead of remembering that control-D is DELETE and control-C is the paragraph marker with automatic indent, the user simply presses the keys with the actual words: CONTROL, DELETE, PARA., etc. It's a shame the other word processors don't provide labels—at most the set costs less than \$1 and is one of the most convenient operating features.

Finally, if you need word processing for anything other than preparing a standard letter, try to get a demonstration that emphasizes the unusual or uncommon word-processing features of primary interest to you. If you're considering software that's available only through the mail, try to get a demonstration from someone in your area who already has it. As with most purchases, it's the only way to determine if it will meet your specific needs.

R-E

Audio Tapes How Different Are They?



MANY THINGS GO INTO GETTING HI-FI PERFORMANCE from cassette tape. Among the most important are high-frequency *tape saturation* and *bias*. We'll be looking at the saturation points of two different types of three well-known brands of cassette tape to see how they compare. We'll also look at how different bias levels affect recordings made on those tapes.

As you probably know, cassette tapes tend to attenuate high frequencies. The frequency at which the tape's response is down 3-dB from the maximum is called the high-frequency saturation point. We'll take a closer look at that shortly.

Bias is a high-frequency signal that is applied to the recording head along with the AF (Audio Frequency) signal. The bias signal preconditions the tape's magnetic coating to sharply reduce (almost eliminate) the natural distortion caused by the hysteresis effect of magnetic materials. Without the preconditioning, low-distortion tape recording could only be made at extremely low volume levels, and the tape noise would be almost as loud as the signal.

A rule of thumb is that the slower the tape speed, the greater the tape's sensitivity to variations in applied bias level. When dealing with the speeds associated with the reel-to-reel recorder, such as 15, 7.5, and 3.75 ips (inches-per-second), a bias value way outside the ballpark will still produce a decent recording. But at the (slow) 1 $\frac{1}{8}$ -ips speed of cassette tape, bias level becomes a critical factor in overall performance—more than anything else, it determines whether a listener accepts the recording as high-fidelity.

There are several reasons for that. Among them is the fact that the modern cassette tape has been improved to the

Some people say that all cassette tapes are the same—you can't tell one from the other. We'll examine some different brands and different types of tape to see if that's true.

HERB FRIEDMAN

point where, within a given price range, the output level (sensitivity) and tape noise (inherent noise level) of different tapes are similar. The same is true with the tapes' overload level, headroom (we'll discuss this shortly), and just about everything else—except modulation noise (which is a subject for the future). On any given day, one tape will slightly outperform any other tape of the same type and price range—it all depends on the particular production run and the direction you tilt your head when you read the test instrument.

The two most obvious characteristics that differ between tapes of the same class is the high-frequency response and the high-frequency saturation at standard record level (0-VU). In the final analysis, it's those two characteristics that determine whether a listener accepts the recorded sound quality as high fidelity.

I know we just said it was the bias level that did that. But that's because the bias level sharply determines the high-frequency response, and, to a lesser degree, the distortion. Within a range of bias-level values that produce low distortion, the

resultant high-frequency response can range from peaked to dull (meaning attenuated highs). Until recently—because tape characteristics varied widely—to get the distortion characteristics where the manufacturer wanted them, it was not uncommon for the optimum bias value for one brand or type of tape to have no relationship to any other brand or type. So many hi-fi cassette decks had adjustable bias-systems that were keyed to equal output between a midrange and a high-frequency—usually about 1000 and 12,000 Hz. There was the time when most “quality” cassette decks had at least one, possibly multiple, bias adjustments for all four types of tape. Cassette recorders were quickly starting to resemble a jet's instrument panel.

Today, however, there are many decent cassette decks available at budget prices because the adjustable bias systems and their associated metering circuits have been eliminated. So how is the tape biased for best performance? By simply turning the tape selector to the appropriate tape type. The fancy trimmers and tweakers aren't really needed because most of the recent high-performance tapes use the same bias values. In fact, the remainder of their performance is so similar it's hard to tell whose tape you're using. You'll probably come out a winner no matter whose tape you use.

Our tests and results

To avoid drowning you in a sea of statistics, we have selected three of the most popular tape brands and types—tape recognized by many as “high-fidelity tape.” There are other brands that are equally good, and we are not trying to recommend that you limit yourself to those shown. We

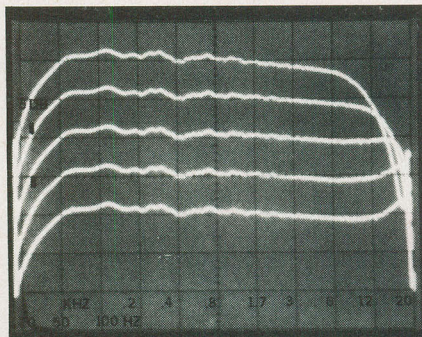


FIG. 1—RESPONSE OF TDK'S TYPE II TAPE with the recorder set to the T-M BIAS level.

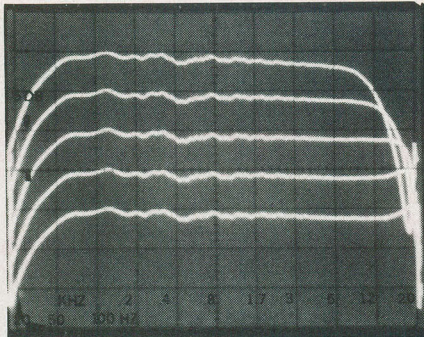


FIG. 2—RESPONSE OF MAXELL'S TYPE II TAPE with the recorder set to the T-M BIAS level.

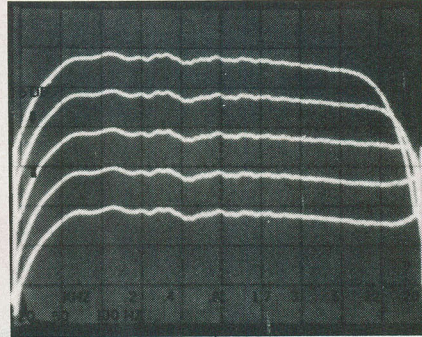


FIG. 3—RESPONSE OF MEMOREX'S TYPE II TAPE with the recorder set to the T-M BIAS level.

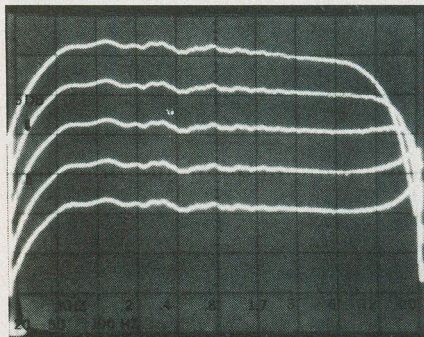


FIG. 4—RESPONSE OF TDK'S TYPE II TAPE with the recorder set to the MEM BIAS level.

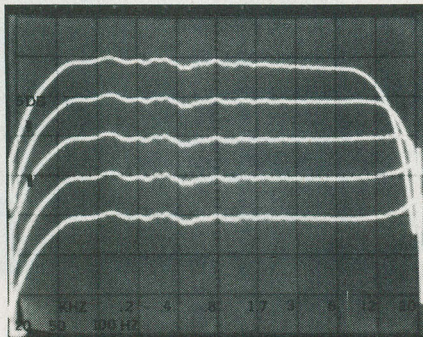


FIG. 5—RESPONSE OF MAXELL'S TYPE II TAPE with the recorder set to the MEM BIAS level.

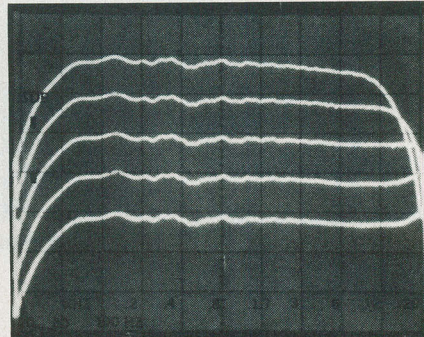


FIG. 6—RESPONSE OF MEMOREX'S TYPE II TAPE with the recorder set to the MEM BIAS level.

have simply selected three of the best known brands: Maxell UDII/S, TDK SA/X, and Memorex HBII. All are high-bias (Type II or chrome-type) tape. We also looked at metal tape (Type IV) from the same three manufacturers.

To avoid throwing a bunch of numbers at you, we have included many illustrations—instead of tables—that describe the tapes' performance.

The test recorder we used was Radio Shack's 3100—a moderate-cost high-performance three-head model. Its quality is typical of what is found in popularly priced decks. Its internal metering system indicated that modern TDK and Maxell (Type II) tape use the same bias value (at least on the test recorder) so that's what we used. (The deck has a two-tone generator that helps you correctly adjust the bias value.) We'll call that bias value T-M BIAS. The machine's optimum bias for Memorex type II was slightly less than for TDK and Maxell tapes, so its value (MEM BIAS) was also used.

Figures 1 through 6 show the effect of the two bias values on all three (Type II) tapes. Figures 1 through 3 show the performance of the tapes using the T-M BIAS value. Figures 4 through 6 show what we get from the same three tapes with MEM BIAS.

In each figure, the top trace represents the output level corresponding to a 0-VU record level; the lower traces are the outputs produced by reducing the input level in steps of 5 dB until we reach the bottom trace, which is 20 dB down. That's the

"standard" test level for cassette tape—you'll see why in a moment.

First, notice that the top trace in each figure shows high-frequency attenuation. While the lower traces actually rise at 20 kHz, the top traces are down about 3 dB somewhere around 8 or 9 kHz (the *corner frequency*). The attenuation is produced by high-frequency tape saturation. Beginning at about 8 kHz there will be no further increase in tape output regardless how much input is applied. The midrange can accept additional input—the so-called "headroom measurement," but it will have no effect on the high end where the saturation level remains as shown in the figures.

Notice that the high-frequency response "extends" as the input level is decreased (in 5-dB steps). It really doesn't extend—we simply are reducing the saturation caused by the input signal. At -20 dB we get a great response, which is why -20 dB is the reference level for cassette machines—at this level even junk looks good.

It is the high-frequency saturation that makes high-level high-frequency signals appear dull and lifeless. If you push the level too high, everything above 8 kHz or 9 kHz heads for the basement. At 12 kHz the response is 5 dB down, and at 15 kHz almost 15 dB down. That's not exactly "sparkling sound quality." To avoid high-frequency saturation, the record level must peak considerably below 0-VU if the program material has substantial high-frequency content.

It's interesting that in terms of frequency response and saturation level the performance from these three brands, which are in competition with each other, are very similar even when the bias levels are mismatched. That's why many hi-fi enthusiasts aren't too fussy about brands and why their tape purchase is often determined more by selling price than "sound quality." (Want to bet that this statement brings in mail from some manufacturer claiming that the shell, or rollers, or slip sheet, or whatever is more important than sound quality?)

Give or take a dB or two in signal-to-noise ratio and output level, the variations between different well-known brands of recent Type II (chrome bias) tape is slight, and overall performance is notably good. Even better performance requires moving up to metal tape, which provides both extended high-frequency response and resistance to high-level tape saturation.

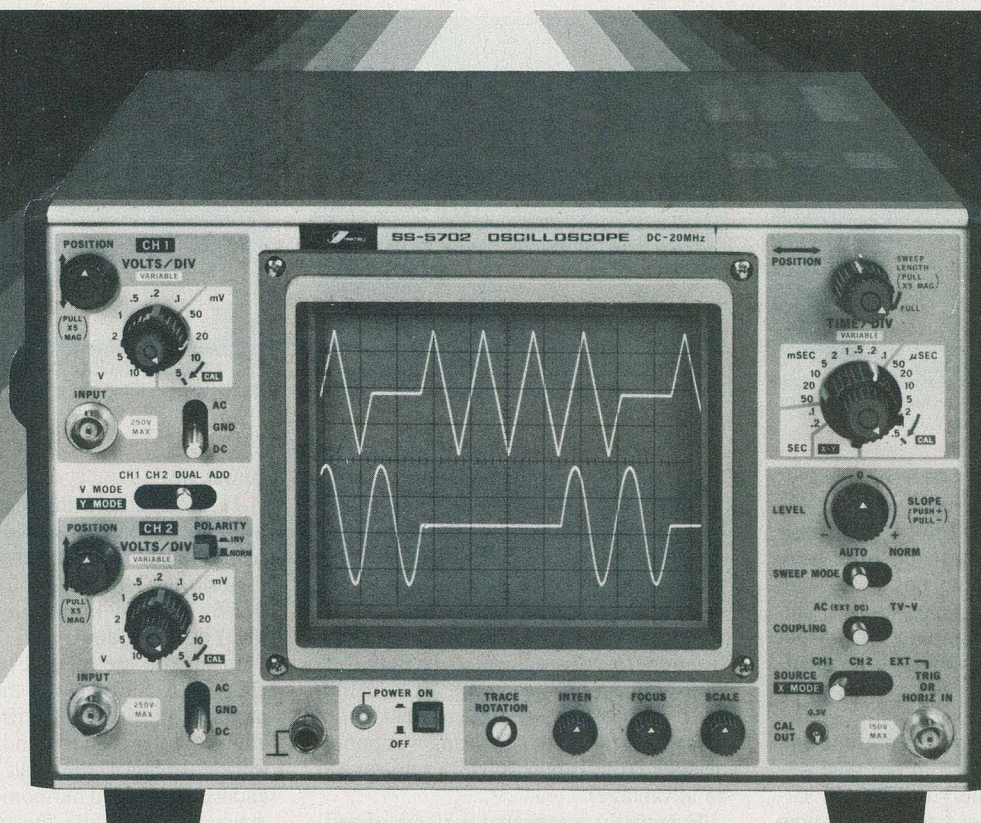
Metal tape

Of all the metal tape attributes, from a listening viewpoint, the most important characteristic is reduced high-frequency saturation. That can be seen by comparing Fig. 7 to the traces for Type II tape. Figure 7 shows the output of the three brands of metal tape at two different recording levels. (Maxell, Memorex, and TDK metal tapes all appear to use the same bias values.) The upper group of traces show the output level produced by a 0-VU record level. The lower group shows the output level resulting from a

AN INNOVATIVE 20 MHz OSCILLOSCOPE THAT EMPHASIZES OPERABILITY

\$535*

The SS-5702 has flexibility and power which make it ideal for the maintenance and troubleshooting of TVs, VTRs, audio equipment and a wide range of other electronic systems by hobbyist as well as professionals. At the top of its class, the SS-5702 uses a 6-inch rectangular, parallax-free CRT.



IWATSU SS-5702 DC~20 MHz OSCILLOSCOPE

IWATSU makes more than 20 oscilloscopes as well as an impressive lineup of other instruments including logic analyzers and digital memory scopes. The fastest oscilloscope has a maximum frequency of 350 MHz. And the same technological expertise and product quality that make this super high-frequency oscilloscope possible are incorporated in the SS-5702.

* User price, including probes.



IWATSU INSTRUMENTS INC.
120 COMMERCE ROAD, CARLSTADT, N J 07072 PHONE: (201) 935-5220, TWX: 710-989-0255

■ In Canada: ATELCO, 3400 Pharmacy Avenue, Unit 1, Scarborough, Ontario, M1W 3J8, Phone (416) 497-2208, TWX 610-492-0122

- 6-inch rectangular, parallax-free CRT
- TV-V trigger
- Variable sweep length
- Double Lissajous figure
- 1 mV/div to 10 V/div sensitivity
- 100 ns/div to 0.2 s/div sweep
- Differential input with ADD mode
- DC operation (optional)

CIRCLE 15 ON FREE INFORMATION CARD

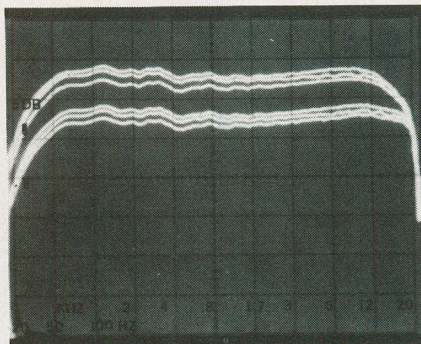


FIG. 7—ALL THREE BRANDS OF METAL (Type IV) tape. The top group shows the output with a 0-VU record level, the bottom group shows the output due to a -5-dB record level.

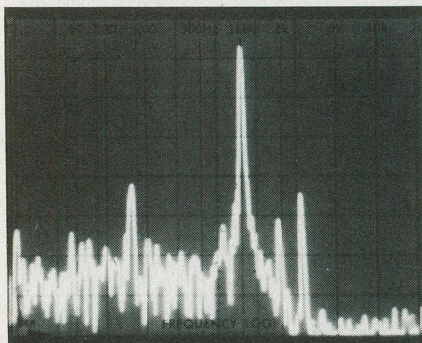


FIG. 10—DISTORTION CHARACTERISTICS for Maxell's metal tape at a +6-VU record level.

-5-dB record level. First, note that the characteristics are almost identical. They're so similar that if the tapes were not identified, we could not know with any certainty if they were, in fact, different. The slight difference in output level between the three brands is no greater than 1.5 dB—a value that can easily be a standard production-variation.

The top traces in Fig. 7 represent a 0-VU record level. Instead of the tape saturating at approximately 8 kHz, the saturation point (or corner frequency) is now at about 13 kHz. It is this "extended" 5-kHz range that provides the brilliance when reproducing music. If you attenuate the highs above 8 kHz, the reproduction appears to be dull and lifeless. Extend the range to 13 kHz and the brilliance is restored even at maximum recording level. Considering the frequency limitations of the typical moderate-price recorder, few listeners would know or realize there was a roll-off (due to the tape) at 13 kHz.

Now look at the lower set of traces in Fig. 7—the output level from metal tape produced by a -5-dB record level. The response goes out to 20 kHz, a level of performance not attained from Type II (chrome-bias) tape until the input level is almost 15 dB down. It is this 10-dB advantage of metal tape that provides a noticeable naturalness (brilliance) to recordings made at high or maximum recording levels.

Another characteristic of metal tape is somewhat greater midband headroom.

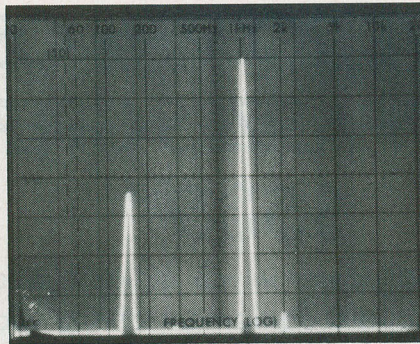


FIG. 8—HARMONIC DISTORTION characteristics of the test system.

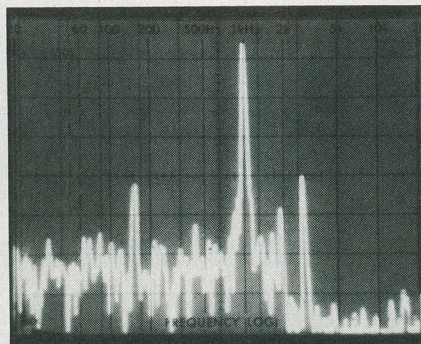


FIG. 11—DISTORTION CHARACTERISTICS for Maxell's metal tape at a +8-VU record level.

That requires some explanation. Back in the early days of cassette tape tests it became somewhat fashionable to measure the difference between the input level that produced a 0-VU record level meter reading and the level that produced 3% THD (Total Harmonic Distortion) at midband frequencies. Somehow, this nebulous measurement of "headroom" was intended to imply some favorable characteristic; actually, it meant the metering was poorly designed (this is how you turn a mistake to an advantage).

Eventually, metering was standardized, but improved tape characteristics—particularly from Type II and IV tape—actually permit higher recording levels than 0-VU because the reference level that drives the tape to the 3% THD standard reference level is greater than 0 VU. The effect of the higher level, or headroom, is shown in Figs. 8 through 13, where each major vertical division represents 10 dB. Since for a given tape type the performance is similar, to keep things simple only one brand of tape is used for the illustrations.

Figure 8 shows the distortion characteristics of the test system—all the associated hardware except the tape itself. The test signal is 1 kHz, whose peak represents the output level for a 0-VU record level. The small peak at 2 kHz is the 2nd-harmonic distortion, which is 65 dB down. It represents about 0.05% THD. The pulse between 100 and 200 Hz is a special low-frequency pulse to give an on-screen check of the system calibration. Ignore it; it has no relevance to our mea-

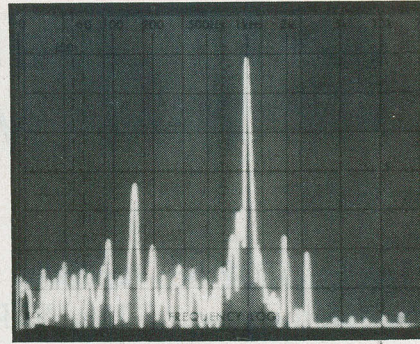


FIG. 9—DISTORTION CHARACTERISTICS for Maxell's metal tape at a 0-VU record level.

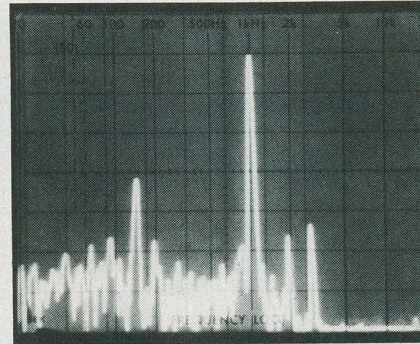


FIG. 12—DISTORTION CHARACTERISTICS for Maxell's Type II tape at a 0-VU record level.

surements.

Figure 9 shows the distortion characteristics for Maxell metal tape at 0-VU record level. Note that the 3rd-harmonic distortion (3 kHz) is 50 dB down, or 0.3%. Second harmonic distortion (2 kHz) is 48 dB down.

In Fig. 10 the input level has been increased by 6 dB. Note, that the 3rd harmonic distortion is 34 dB down (2.2%) and is greater than the 2nd harmonic distortion. In Fig. 11 the input level is +8 dB and we see the 3rd harmonic is now 32 dB down (2.5%). Note that there is not a corresponding increase in output level—the tape is saturated.

In comparison, to those three figures, examine Figs. 12 through 14, which show the same input-level conditions for Maxell Type II (chrome-bias) tape. Note that at 0-VU record level (Fig. 12) the 2nd and 3rd harmonic distortion is similar to that of metal tape. But with a +6-dB input (Fig. 13) the 3rd harmonic increases dramatically—it is only 24 dB down (6.1%), while with a +8-dB input (Fig. 14) the 3rd harmonic is 23 dB down (6.5%) with considerable increase in the 5th harmonic. In fact, we can, for the first time, begin to distinguish the 5th harmonic from the "noise floor." Its effect will be barely (if at all) noticeable because it is more than 6 dB down from the 3rd harmonic. Any further "overload" of the tape will sharply increase the 5th harmonic component.

As you can see, the bias/frequency response characteristics show that some of

continued on page 88

UNGAR DESOLDERING & SOLDERING

Special Pricing... Special Free Offer

Hot VAC Desoldering System



Model 4000

Built-in vacuum pump eliminates the need for shop air. Compact design and portability make it ideal for use at any location where there is an AC electrical plug-in outlet.
Self-Contained, Super-Quiet Air Pump: The vacuum pump is not only virtually maintenance free, it is remarkably quiet. The pump operates only when the handle switch is actuated.

Temperature Control: Variable solid-state control that adjusts the tip temperature from 500° - 1000° F. An electric circuit assures that transient spikes are fully suppressed thereby making the system safe for desoldering voltage-sensitive components.

Reg \$599.95
OUR SPECIAL PRICE

\$379⁹⁵

Electronic Temperature Controlled Soldering System with Built-in Controller

OUR SPECIAL PRICE \$89⁹⁵



Model 9100

Includes: base unit with built-in controller, micro-size handle with THERMO-DURIC heater, 1/16" #9012 screwdriver tip, sponge and tip tray, sponge, and Iron Holder. A low cost alternative in an operator-adjustable, temperature controlled soldering system.

• Electronic, closed-loop temperature control for maximum precision • Temperature is operator-adjustable from 400° F to 800° F • Continuous, variable control so you can select the exact temperature you need • Neon "on-off" light • Iron Holder can be right- or left-hand mounted to accommodate all operators.

FREE UNGAR 9100
 with purchase of
 Ungar 4000

TOLL FREE (800) 645-9518

FORDHAM



260 Motor Parkway, Hauppauge, N.Y. 11788

in N.Y. State 800-832-1446

■ VISA ■ COD ■ Master Charge
 ■ Money Order N.Y. State residents add
 ■ Check appropriate sales tax.
 COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE

\$250.00	\$4.50
\$251.00 to 500.00	6.50
501.00 to 750.00	8.50
751.00 to 1000.00	12.50
over 1000.00	15.00

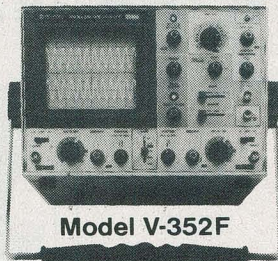
FORDHAM DISCOUNTS DISCOUNT PRICES ON HITACHI SCOPES

SPECIAL OFFER!
For a limited time only

35 MHz DUAL TRACE SIGNAL DELAY LINE

Vertical sensitivity 5m V/div to 5V/div and 1m V/div to 1 V/div with 5X amplifier • Trigger modes Automatic, Normal, TV (+), TV (-).

REG \$895
OUR PRICE
\$599⁹⁵
 WITH PROBES



Model V-352F

60 MHz DUAL TRACE DELAYED SWEEP

High sensitivity • 1 mV/div (10 MHz) • 5 ns/div sweep rate • 3rd channel display (trigger view) • Variable trigger hold-off • Full TV triggering • Single sweep • Automatic focus correction.

OUR PRICE
\$995
 WITH PROBES

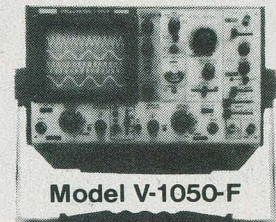


Model 650F

100 MHz QUAD TRACE DELAYED SWEEP

Large, bright 8x10 cm screen • Quad trace operation/Ch1, Ch2, A trigger and B trigger • High sensitivity 500 μ V/div (5 MHz) • Full TV triggering.

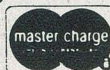
OUR PRICE
\$1590
 WITH PROBES



Model V-1050-F

TOLL FREE (800) 645-9518

FORDHAM



260 Motor Parkway, Hauppauge, N.Y. 11788

in N.Y. State 800-832-1446

■ VISA ■ COD ■ Master Charge
 ■ Money Order N.Y. State residents add
 ■ Check appropriate sales tax.
 COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE

\$250.00	\$4.50
\$251.00 to 500.00	6.50
501.00 to 750.00	8.50
751.00 to 1000.00	12.50
over 1000.00	15.00



a temperature-adjustable soldering iron for less than \$40

A 50-watt iron that can be adjusted with $\pm 2\%$ accuracy anywhere between 400°F and 750°F using the allen wrench provided. 3-wire burn resistant cord, stainless steel shaft and on/off light with 10 different long-life replacement tips available. **No. 7200**

Add an ISO-TIP safety stand with tip-wiping sponge for a complete soldering station. **No. 7295**

Write for the name of your nearest distributor and a free catalog.



WAHL CLIPPER CORPORATION
Sterling, Illinois 61081 • (815) 625-6525

CIRCLE 97 ON FREE INFORMATION CARD

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

AUDIO TAPES

continued from page 85

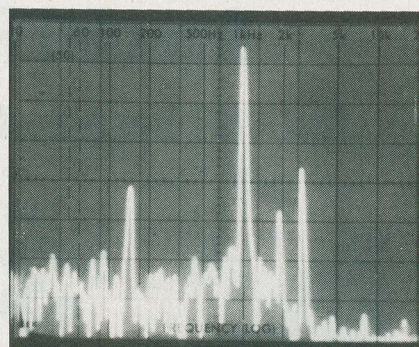


FIG. 13—DISTORTION CHARACTERISTICS for Maxell's Type II tape at a +6-VU record level.

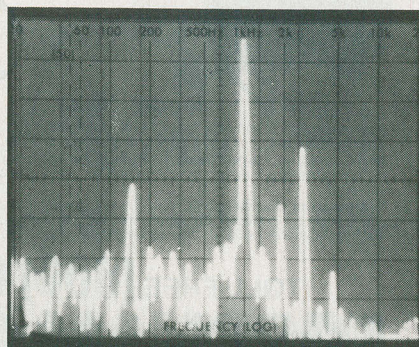


FIG. 14—DISTORTION CHARACTERISTICS for Maxell's Type II tape at a +8-VU record level.

the best known brands of Type II tapes are similar with regard to their frequency response and bias requirements. The metal tapes are so much alike that they appear to have come from the same source (though that's very unlikely).

Overload tests clearly illustrate the increased maximum-level high-frequency response and the increased "headroom" capacity of Type IV (metal) tape when compared to Type II tape.

What it all comes down to is that well-known tape brands have a reputation they deserve, and if you keep recording levels from "pinning the meter" you don't have to pay the extra cost of Type IV tape—Type II can work just fine. **R-E**

BE A COMPUTER PROGRAMMER

Train at home in spare time! No previous experience needed! Now you can learn it all! Computer programming... computer applications... computer games... everything you ever wanted to know about computer operations. Use hundreds of programs already available or write your own... budgeting, real estate, bookkeeping, expenses, investments, interest, taxes, shopping lists, vacation planning, addresses, phone numbers... even foreign languages and graphics. Experts explain everything in easy-to-understand language with step-by-step directions. Timex computer included with your training... plugs in to any TV. Send for free facts! **ICS**

COMPUTER TRAINING, Dept. DE0A3
Scranton, Pennsylvania 18515

Rush free facts how I can learn computer applications, programming and operation at home in spare time.

Name _____ Age _____
Address _____
City/State/Zip _____

COMPLETE CIRCUIT REPAIR KITS

Repair PCB circuitry quickly, easily.
A.P.E.'s SRS-050 Repair Kits give you everything you need to repair or replace actual Printed Circuit Board circuitry, including plated through-holes where an interfacial connection is required. Five kits provide the right quantities of circuitry, tools and materials for your needs plus a comprehensive instruction manual. Call or write for full details.
Automated Production Equipment Corp., 142 Peconic Ave., Medford, NY 11763 • 516-654-1197 • TWX: 510-228-2120

BEFORE **AFTER**
DEPEND ON A.P.E.

CIRCLE 56 ON FREE INFORMATION CARD

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

TIMEX SINCLAIR

Software

Top Games

Mr. Munchie — (Arcade) **\$14.95**
Speed Snake — (Arcade) **\$14.95**
Bridge — (Card) **\$14.95**
Chess I. **\$14.95**
Chess Master. **\$24.95**
Trader Trilogy
(Fantasy)..... **\$14.95**
Alien Space Ship
(Adventure)..... **\$14.95**

Home & Business

Personal Financial Pack
(2 tapes)..... **\$29.95**
Stock Market Planning
(2 tapes)..... **\$29.95**
Business Cash Management
(2 tapes)..... **\$29.95**
Diet Programme
(2 tapes)..... **\$29.95**

Programming Aids

Fastload (Load and save
6 times faster)..... **\$19.95**
ZX Assembler..... **\$14.95**
ZX Bug (Monitor &
Disassembler)..... **\$14.95**
Toolkit (9 new functions) **\$14.95**

LANGUAGES

Tiny Logo..... **\$19.95**
Forth..... **\$29.95**

Hardware Specials

64 K RAM..... **\$99.95**
Professional Keyboard with
Metal Case..... **\$79.95**
Memotech 16K RAM.... **\$29.95**

Books

Timex Sinclair
Learning Course
with Binder,
2 Program Tapes
\$24.95

Free Catalog

All software is
compatible with
TS1000 TS1500
ZX81 Computers!
Call or write NOW!
COMING SOON!
New TS2068 software!

GLADSTONE

Electronics Inc.
1585 Kenmore Ave.
Buffalo, NY 14217

Mail Orders: VISA, MASTERCARD.
Cheques or Money Orders. Add \$1.50 shipping.

In Canada: 1736 Avenue Rd., Toronto, Ont. M3J 2W6 800-268-3640

ORDER TOLL FREE
800-833-8400

Have VISA or MASTERCARD ready!

In New York
716-874-5510

CIRCLE 19 ON FREE INFORMATION CARD

QUALITY SPECIALS

SOPHISTICATED I.C.'S

DATA SHEETS ARE PROVIDED FREE
WITH ALL INTEGRATED CIRCUITS LISTED BELOW

PART #	DESCRIPTION	PRICE (ea.)
LS7232	TOUCH SENSITIVE LIGHT DIMMER SWITCH. MOMENTARY TOUCH TO SENSOR PLATE TURNS LIGHTS ON OR OFF. PROLONGED TOUCH GRADUALLY DIMS OR BRIGHTENS. A SLOW CLOCK INPUT ALLOWS AUTOMATIC SLOW DIMMING TO OFF IDEAL FOR SOLVING CHILD'S FEAR OF DARK BEDROOM.	\$4.50
RDD104	CMOS DIVIDER I.C. HAS TRUTH-TABLE SELECTABLE INPUT TO YIELD DIVIDE BY 10, 100, 1000, OR 10000 OUTPUTS.	\$3.50
LS7031	D.C. TO 5MHz SIX DECADE MOS UP COUNTER WITH 8 DECADE LATCH AND MULTIPLEXED BCD OUTPUTS AND DIGIT STROBES ACCESS TO LSD LATCHES ALLOWS ATTACHMENT OF PRESCALERS FOR COUNTING TO 500MHz.	\$13.75
LS7220	14 PIN DIP AUTOMOTIVE MARINE ANTI-THEFT DIGITAL LOCK CIRCUIT HAS 5000 4-DIGIT COMBINATIONS WITH 25 MICROAMP STANDBY 'SAVE' MODE FOR VALET PARKING.	\$3.50
XR2228CN	MULTIPLIER DETECTOR I.C. FOR ANALOG SIGNAL PROCESSING. CONTAINS 4 QUADRANT ANALOG MULTIPLIER-MODULATORS AND INDEPENDENT HIGH GAIN OP-AMP DIFFERENTIAL X-Y INPUTS. APPLICATIONS FOR PHASE DETECTION UP TO 100 MHz. PLL DESIGN IN SYNCH AM DETECTION OR GENERATION. TRIANGLE TO SINEWAVE CONVERSION OR FREQUENCY TRANSLATION.	\$3.20
ICL8038	PRECISION WAVEFORM GENERATOR I.C. PRODUCES SINE SQUARE TRIANGLE SAWTOOTH OR PULSE WAVEFORMS WITH MINIMUM EXTERNAL COMPONENTS FROM 0.01Hz TO 1 MHz. FOR PRECISION PLL TEST INSTRUMENTS.	\$3.75
XR215CN	HIGH FREQUENCY PHASE-LOCKED LOOP (PLL) I.C. FOR BOTH ANALOG AND DIGITAL COMMUNICATIONS 0.5Hz TO 30MHz. USES INCLUDE FM DEMODULATION, FREQUENCY SYNTHESIS FOR CODING/DECODING, MODEM, DTL, TTL, ECL LOGIC COMPATIBLE.	\$4.20
CS258A	INTRUSION ALARM OPTICAL TRANSDUCER I.C. NEEDS IR LED PHOTO DIODE & PASSIVE PARTS TO BE COMPLETE OPTICAL TRANSDUCER SYSTEM CAN BE FAIRLY OPEN TO AMBIENT LIGHT WITHOUT FALSE ALARMS.	\$5.95
UGN3501T	HALL EFFECT SENSOR FOR MAGNETIC FIELD CHANGES TOO SMALL TO OPERATE THE HALL SWITCHES. OUTPUT IS A LINEAR FUNCTION OF MAGNETIC FIELD INTENSITY. MONOLITHIC I.C. INCLUDES HALL CELL, AMPLIFIER AND VOLTAGE REGULATOR FOR A 4.5 TO 24VDC SOURCE. HIGH SENSITIVITY AND FLAT RESPONSE. 3 PIN T-PACK.	\$2.80
UGN3501M	SAME AS UGN 3501T BUT WITH PROVISION FOR NULLING THE OUTPUT OFFSET VOLTAGE. 8 PIN DIP.	\$2.80
UGN3604M	HALL EFFECT SENSOR WITH DIFFERENTIAL OUTPUT. A LINEAR FUNCTION OF MAGNETIC FLUX SUPPLIED WITH INDIVIDUAL CALIBRATION CHART AT 25 DEGREES CELSIUS & 5 VOLTS. FOR CALIBRATING, TESTING AND ALIGNING MAGNETIC SENSING DEVICES. 8 PIN DIP.	\$8.50

HALL EFFECT DEVICES

FREE CATALOG OF NEW DEVICES

**GOLDSMITH
SCIENTIFIC**
CORPORATION

P.O. BOX 318R, COMMACK, NY 11725
PHONE ORDERS WELCOME—(516) 979-7944

MASTER CARD AND VISA ACCEPTED
NEW YORK STATE RESIDENTS ADD SALES TAX
POSTAGE—ADD 5% PLUS \$1.50 INSURANCE, C.O.D. \$2.00 EXTRA
AVAILABILITY OF CERTAIN ITEMS MAY BE LIMITED.

CIRCLE 69 ON FREE INFORMATION CARD

TAFT

**ELECTRONIC
SALES**

HAS IT ALL FOR LESS

OVER 10,000 PARTS IN STOCK—CALL FOR LOW PRICES

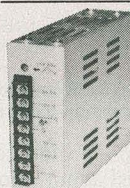


\$88⁸⁸

"ALL-IN-ONE VIDEO PROCESSING CENTER"

- STABILIZER - Eliminates picture roll/jitter
- IMAGE ENHANCER - Adjusts picture contrast/clarity and detail for improved home viewing and recording or dubbing
- RF CONVERTER - Converts video and audio direct line outputs from any VCR component, TV or video camera to an "RF" signal
- VIDEO FADER - Produces gradual "fade-ins" or "fade-outs" with professional results
- DISTRIBUTION AMPLIFIER - Provides extra signal gain needed for best results (dual output)

COMPUTER POWER SUPPLY



\$69

4 CHANNEL SWITCHING

- +5V @ 5A, -5V @ 1A,
+12V @ 1A, -12V @ 1A
- INPUT 90-130V AC
- REGULATION: LINE $\pm 0.2\%$
LOAD $\pm 1\%$
- RIPPLE: 30 MV P-P



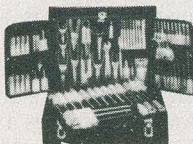
FLUKE

- 8060A **\$345**
- 8062A **\$267**
- 8022B **\$143**
- 8020B **\$193**
- 8024B **\$247**

BECKMAN

- 300 **\$109**
- 310 **\$129**
- 330 **\$199**

Xcelite®

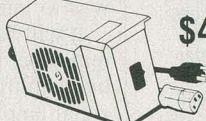


- TC-100ST XCELITE'S
BEST CONTAINS
53 TOOLS **\$329**
- TC-150ST SMALLER
VERSION **\$279**



- 99SM ROLL KIT **\$65**

COOLING FAN for APPLE II, II+ and IIe*



\$49

- SNAPS ON SIDE OF APPLE
II, II+ AND IIe* ENCLOSURE
- ELIMINATES OVERHEATING
PROBLEMS
- BOOSTS RELIABILITY AND
LIFE OF COMPUTER
- FRONT ILLUMINATED
SWITCH OF FAN SERVES
AS POWER SWITCH FOR
FAN AND COMPUTER
- BUILT IN LINE SURGE
SUPPRESSION
- TWO ADDITIONAL AC
OUTLETS PROVIDED



3 1/2 DIGIT MULTIMETER



\$79.88

MODEL 8050

- 8 separate functions (30 ranges)
including diode and transistor
check, 10 AMP range on AC
and DC
- Single rotary switch for all
functions/ranges
- Accuracy $\pm 0.5\%$ DVC
- 6 1/4" x 3 1/2" x 1" Small
enough to fit into shirt pocket
- One year parts and labor warranty
- #CC531 Carrying Case — **\$9.90**

TAFT ELECTRONIC SALES

68 W. 45th Street
N.Y.C., N.Y. 10036

CALL
212-575-
8632

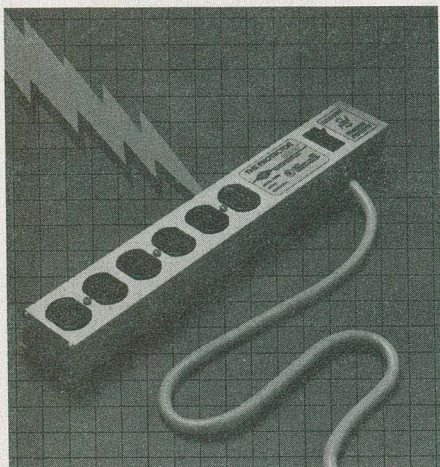
- MASTER CHARGE • VISA
- MONEY ORDER • CHECK
- 25% DEPOSIT ON C.O.D.'s

ADD FOR SHIPPING

UP TO \$300.00 - \$5.50
OVER \$300.00 - \$8.00
N.Y.S. ADD SALES TAX

CIRCLE 38 ON FREE INFORMATION CARD

INTRODUCING



THE PROTECTOR 6000™

TOTAL PROTECTION FOR YOUR SENSITIVE ELECTRONIC EQUIPMENT.

Something that you can't even see may be slowly but surely killing your expensive electronic equipment. It's transient voltage, and it can be fatal to computers, medical equipment, electronic games, videotape recorders, electronic test equipment, electronic cash registers — almost any of today's sophisticated solid state equipment.

THE TRANSIENT VOLTAGE PROBLEM.

Most of this modern electronic equipment uses LSI and MOS semiconductor devices which are extremely sensitive to voltage transient surges or "glitches." In fact, a large percentage of equipment failures can be directly linked to the damaging effects of over-voltage line transients to unprotected, highly fragile components.

THE PROTECTOR 6000™ SOLUTION.

Not to be confused with other transient voltage protection units available today, THE PROTECTOR 6000 uses state-of-the-art solid state components and exclusive circuitry to provide you with complete and total protection from transient voltage surges of up to 6,000 volts. THE PROTECTOR 6000 uses silicon PN junction devices — proven to provide the fastest response to surges! They have a statistical life expectancy of over 20 years. THE PROTECTOR 6000 has a maximum clamping voltage of only 335 volts, well below the voltage rating of other transient protection devices which commonly use much less effective MOV's or gas discharge tubes. It also provides full protection from electro-magnetic and radio frequency interference. The unit operates in both common and differential modes, and is outfitted with a circuit breaker to guard against severe current overloads over 15 amps.

Why take chances with your expensive electronic equipment? For full details contact your local NTE distributor or write:



NEW-TONE ELECTRONICS, INC.

44 Farrand St., Bloomfield, NJ 07003

THE PEOPLE WHO BRING YOU THE TCG LINE OF SEMICONDUCTORS.

© 1983 New-Tone Electronics, Inc.

ECL LOGIC CIRCUITS

continued from page 68

coax represent a well-defined impedance that is easily terminated, but it also provides good protection against cross-talk and noise.

There are several types of coax available for the job: RG58U, RG59U, etc. However, coax suffers from a noticeable attenuation of signal as the frequency increases. In other words, that type of connecting cable may not be suitable for all your interfacing, especially if the frequency is high and distances are long. The graph in Fig. 11 illustrates the point by showing you the maximum length of the coax as a function of input frequency

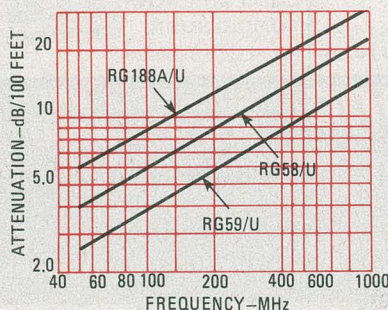


FIG. 11—ATTENUATION BECOMES A problem at high frequencies when using coaxial cable.

for three popular types.

Moreover, because of reactive loading, the fanout of a coaxial cable must be considered at high frequencies. For example, at 300 MHz it should be limited to no more than four. This is one of those situations where the logic tree comes in handy.

Unfortunately, both the open wire and the coaxial cable are afflicted by the shortcomings of a single-ended line. Things like ground loops, power-supply variations, and DC shifting from temperature differences must all be taken into account. Fortunately, there is another way to interface ECL IC's.

It will be easily understood if you first remember that an ECL gate is a differential amplifier. And because it is a differential amp, it has many of the desirable characteristics associated with differential design, including high common-mode rejection. As you recall, most ECL gates provide both OR and its complementary (NOR) output. Since the two outputs are always in mutual opposition, it presents the perfect opportunity to exploit the common-mode-rejection properties of an ECL IC. Making use of those properties allows us to connect two functions with nothing more than a twisted pair of wires.

The twisted pair is wired to both the OR and NOR outputs and connected to the

input of an ECL line receiver. A line receiver is really nothing more than an ECL gate that has both inputs of the amplifier available to the user. Any noise that the twisted leads may pick up along the way will be induced in both wires equally; that is, the noise will have the same amplitude and polarity in both lines. This signal is then input into the line receiver and, as is the nature of differential inputs, the noise is cancelled out. That leaves us with only the digital information, which, of course, is what we desire.

Terminating twisted pairs

Thanks to differential design, twisted pairs provide the maximum noise immunity for any transmission line. As a result of this noise-free input, other parameters can be relaxed, including line terminations.

For reliable operation, the outputs of the driving gate must be terminated. The pull-down resistor is normally located right at the output pin, and more often returns to the $-5.2\text{-volt } V_{EE}$ line, thus eliminating the additional V_{TT} supply, as we see in Fig. 12. You'll notice that both outputs are terminated similarly so that the driving source is balanced. Next, the twisted pair must be terminated at the receiving end. That is not a critical step, in contrast to the pains we took to assure proper termination of a single-ended transmission line.

The actual impedance of the line will vary depending on the wire gauge, insulation thickness and dielectric constant, and tightness of the twist. A 100-ohm resistor across the receiver inputs will usually be more than adequate. Any mismatch that may occur here is virtually ignored by the receiver.

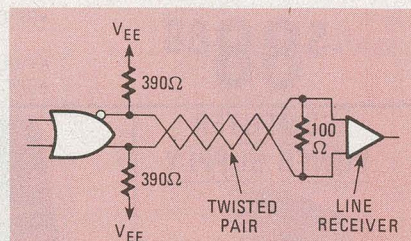


FIG. 12—A SIMPLE TWISTED PAIR connected to a line receiver can reduce common-mode noise.

And there you have it—a short course in ECL design. We must admit, though, that we have only touched on the subject. An interesting aspect of understanding microstrip theory and design, apart from its ECL applications, is that it is so applicable to many of the newer high-speed devices becoming available to the experimenter. Circuits like downlinks and ultraband communications rely almost exclusively on microstrip techniques, and are currently within the realm of practical experimentation.

R-E

If the AP Products 8 page insert is missing circle 87 on free information card.

MAKE THE A P CONNECTION

See the A P PRODUCTS Rack Display with a complete line of Interconnection Products and Accessories at your nearby Electronics Dealers.



price

Socket

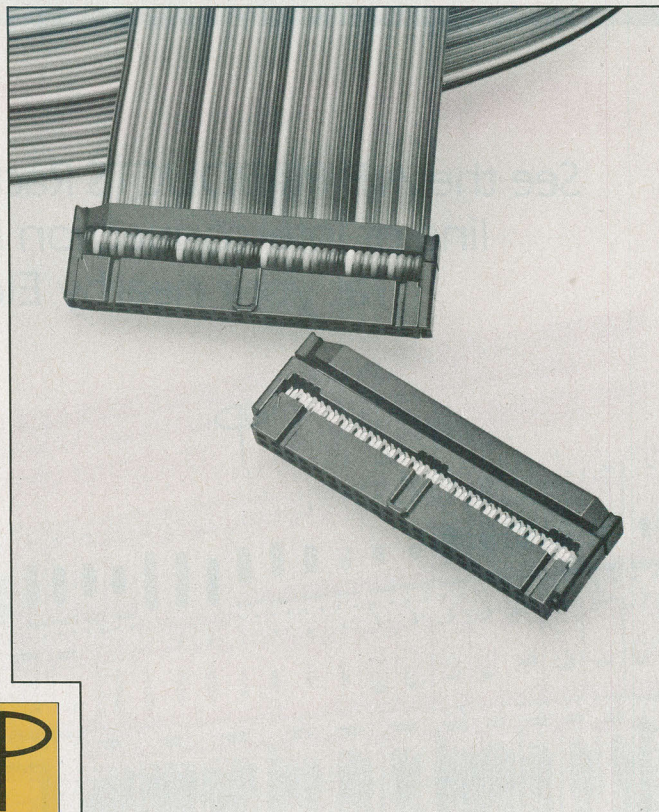
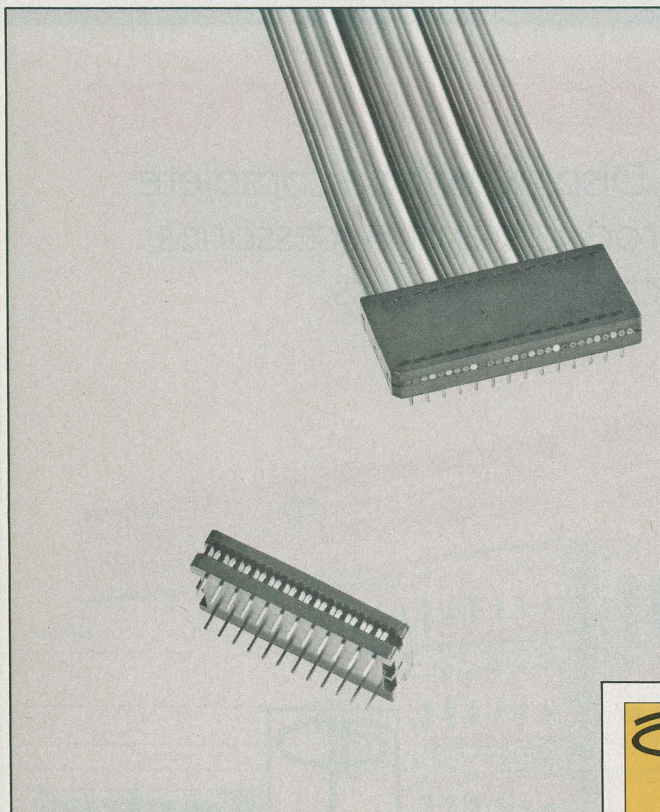
34-CONTACT, GOLD
IDC STYLE
925110-34-R

Tear out this
perforated
8 page
catalog.

A P PRODUCTS



A P PRODUCTS



IDC DIP PLUG CONNECTOR FOR BOARD TO BOARD OR TEST JUMPER SYSTEMS

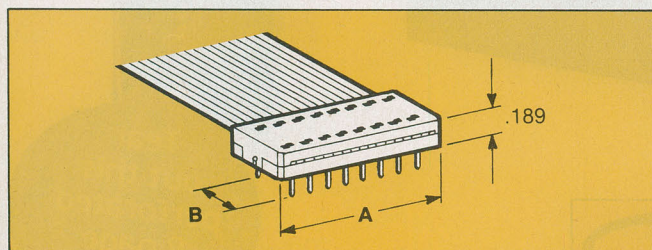
A P PRODUCTS DIP Plug Connectors are designed for quick termination using A P's ribbon cable and application tooling. As with all A P PRODUCTS IDC connectors, cable alignment grooves in the cover provide accurate positioning of conductor over contact area. The "feed through" cover also allows for easy daisy chaining of connectors.

Our tin plated contacts make an affordable means of interfacing with a PC

board either by soldering or by plugging into a standard IC socket.

With the six most popular sizes available, A P can easily fill your requirements.

SPECIFICATIONS	
Materials	
Insulator	Thermoplastic Polyester 94 V-0
Contacts	Phosphor Bronze
Plating	100 Millionths tin over nickel
Tooling	
Assembly Tool	Part No. 925980-R
Die Set	Part No. 925982-R



Part Number	Number of Contacts	"A" Dim.	"B" Dim.
925120-14-R	14	.79"	.30"
925120-16-R	16	.88"	.30"
925120-20-R	20	1.09"	.40"
925120-24-R	24	1.32"	.60"
925120-28-R	28	1.52"	.60"
925120-40-R	40	2.13"	.60"

IDC SOCKET THE EASY INTERFACE TO ALL MALE HEADERS

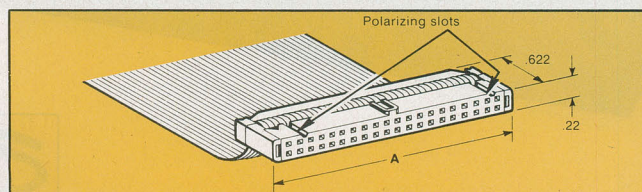
The A P PRODUCTS polarized socket connectors are ideal for all quick connect/disconnect applications to .025" square posts on .10" centers. Contacts are gold plated in the receptacle area with gold flash in the crimp area. This reduces cost while maintaining very high reliability. As with all of our IDC connectors, the cover has grooved ridges which assure easy and accurate alignment of the cable over the insulation piercing contacts. Our "feed through" cover also makes daisy chaining of connectors a snap. Termination of the connector is a quick process using

A P PRODUCTS application tooling and either discrete wire or A P's multiconductor cable.

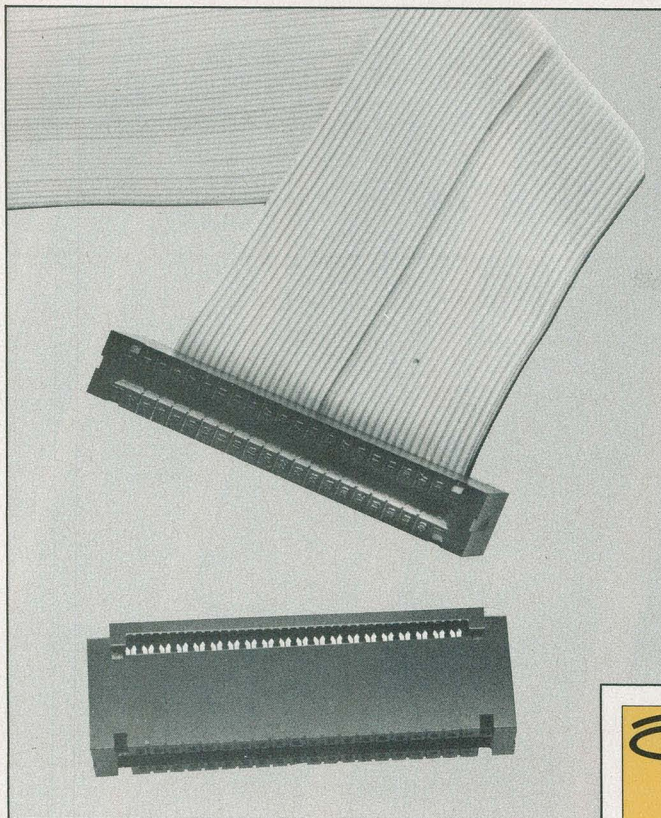
Every socket also comes with a strain relief.

All A P PRODUCTS sockets mate with our strip headers, boxed headers or our latch headers.

SPECIFICATIONS	
Materials	
Insulator	Thermoplastic Polyester 94 V-0
Contacts	Phosphor Bronze
Plating	10 millionths gold in contact area Gold Flash in crimp area (100 millionths nickel under both)
Tooling	
Assembly Tool	Part No. 925980-R
Die Set	Part No. 925981-R



Part Number	Number of Contacts	"A" Dim.
925110-10-R	10	.88"
925110-16-R	16	.98"
925110-20-R	20	1.18"
925110-26-R	26	1.48"
925110-34-R	34	1.88"
925110-40-R	40	2.18"
925110-50-R	50	2.68"
925110-60-R	60	3.18"
925110-64-R	64	3.38"

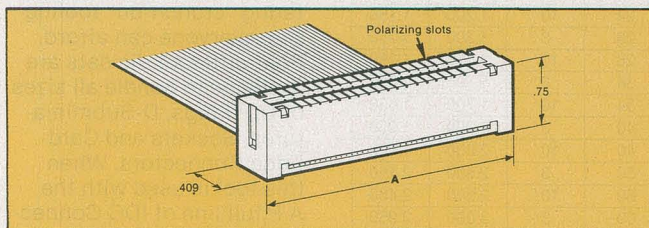


IDC CARD-EDGE FOR INTERCONNECTION BETWEEN PRINTED CIRCUIT BOARDS

The A P PRODUCTS IDC Card-Edge connectors are a quick and reliable interface to standard 1/16" boards with double-sided PCB pads on .100" centers. The cover is designed not only for feed through and daisy chain applications but also contains self-alignment slots on the underside. These slots provide for easy cable positioning over contacts. Terminations are a snap with A P PRODUCTS Cable and Assembly Tool. Each gold plated contact is of a bifurcated design

which assures excellent contact on PCB pads.

SPECIFICATIONS	
Materials	
Insulator	Thermoplastic Polyester 94 V-0
Contact	Phosphor Bronze
Plating	10 millionths gold on contact area Gold Flash on crimp area (100 millionths nickel under both)
Tooling	
Assembly Tool	Part No. 925980-R
Die Set	Part No. 925983-R



Part Number	Number of Contacts	"A" Dim.
925130-20-R	20	1.46"
925130-26-R	26	1.76"
925130-34-R	34	2.16"
925130-40-R	40	2.46"
925130-50-R	50	2.96"
925130-60-R	60	3.46"
925130-64-R	64	3.66"

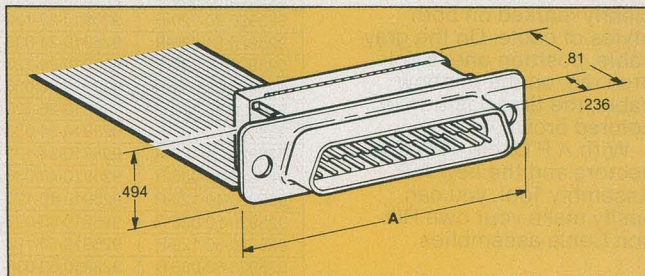


IDC D-SUBMIN PROVIDES EASY CONNECTIONS — NO CABLE PREPARATION NEEDED.

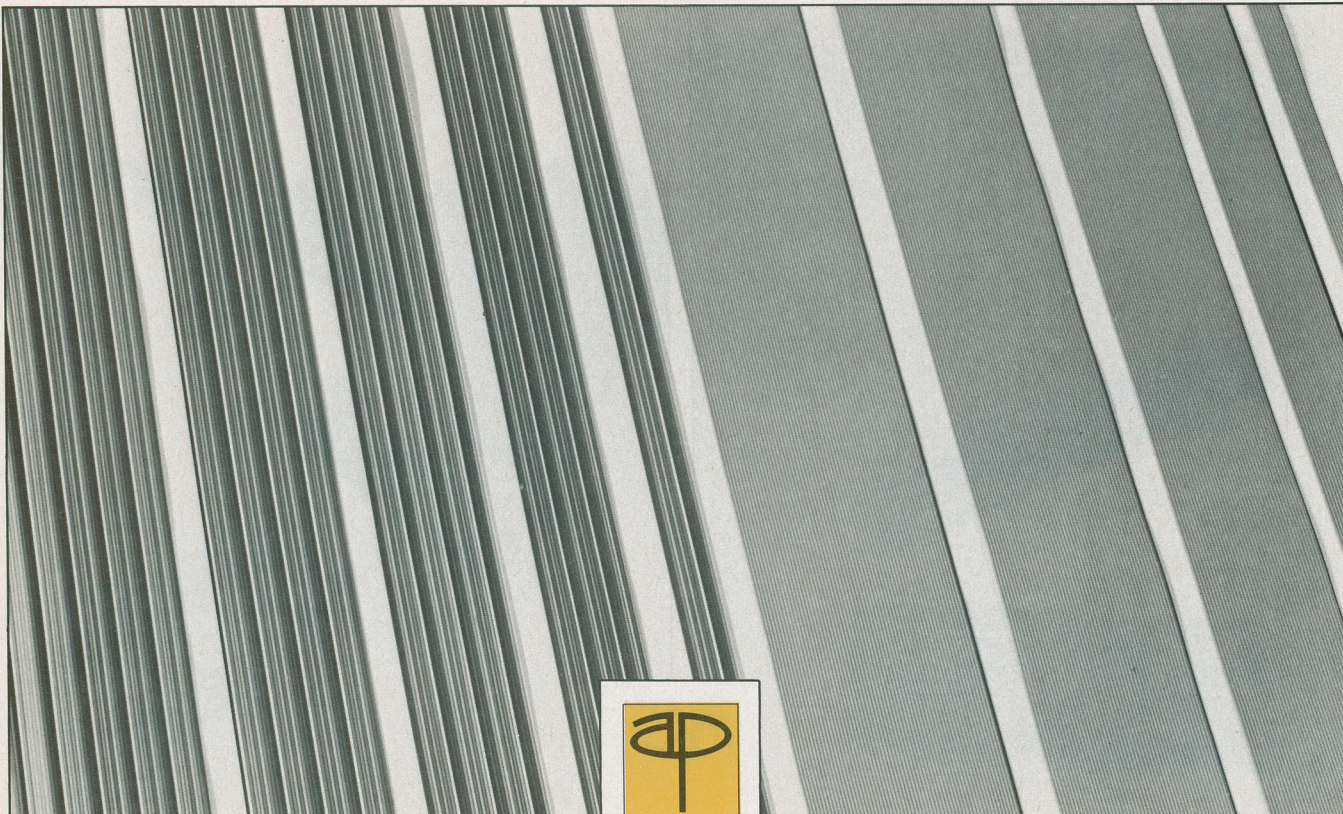
Mass termination of ribbon cable to a D-Subminiature connector is a simple matter using A P PRODUCTS connectors and cable. This system utilizes our standard 28 AWG stranded cable and there is no cable preparation necessary. After inserting the cable into the connector along the grooved alignment ridges in the cover, the termination is easily made using the A P PRODUCTS IDC Assembly Tool. The "feed-

through" cover also allows for easy daisy chaining of connectors.

SPECIFICATIONS	
Materials	
Insulator	Glass-filled Polyester 94 V-0
Contacts	Phosphor Bronze
Plating	20 Millionths selective gold over nickel
Tooling	
Assembly Tool	Part No. 925980-R
Die Set	Part No. 925984-R



Part Number	Description	"A" Dim.
925140-15-R	15 Contact-male	1.54"
925140-25-R	25 Contact-male	2.09"
925140-37-R	37 Contact-male	2.74"
925145-15-R	15 Contact-female	1.54"
925145-25-R	25 Contact-female	2.09"
925145-37-R	37 Contact-female	2.74"



FLAT RIBBON CABLE THE PERFECT MATE FOR A P IDC CONNECTORS

A P Ribbon Cable is available in eleven sizes, from 10 conductors to 64. All sizes come in both gray and rainbow and in either 3 foot or 10 foot lengths.

We use industry standard 28 AWG conductor size on .050" center to center spacing.

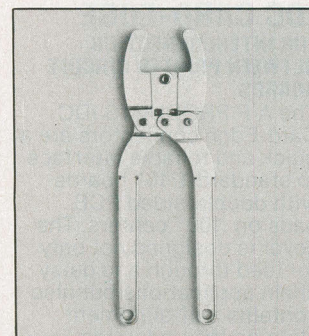
All A P PRODUCTS cable is insulated with standard PVC material and "tear down" separation between conductors is easy to accomplish.

The first conductor is clearly marked on both styles of cable. On the gray cable, position one is colored red; on the rainbow cable, the first position is colored brown.

With A P Cable, IDC Connectors and the new A P Assembly Tool, you can easily make your own Ribbon Cable assemblies.

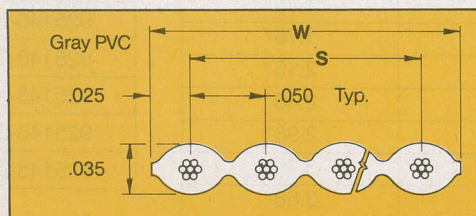
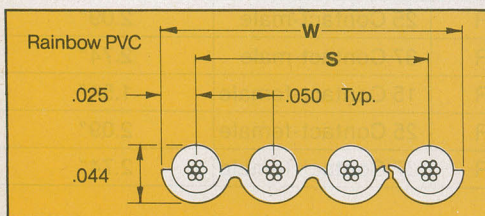
SPECIFICATIONS		
	Gray	Rainbow
Edge Polarity Stripe	Red	Brown
Insulation	Gray PVC (polyvinyl chloride)	Rainbow PVC with clear PVC laminated backing layer
Color Code	Gray	1-Brown 6-Blue 2-Red 7-Violet 3-Orange 8-Gray 4-Yellow 9-White 5-Green 10-Black
Conductors	28 AWG (7-strand bundle of tinned 36 AWG copper wires)	

Rainbow Cable Part Number	Gray Cable Part Number	No. Cond.	Length	"W" Dim.	"S" Dim.
925920-10-036-R	925910-10-036-R	10	3'	.500	.450
925920-10-120-R	925910-10-120-R	10	10'	.500	.450
925920-14-036-R	925910-14-036-R	14	3'	.700	.650
925920-14-120-R	925910-14-120-R	14	10'	.700	.650
925920-16-036-R	925910-16-036-R	16	3'	.800	.750
925920-16-120-R	925910-16-120-R	16	10'	.800	.750
925920-20-036-R	925910-20-036-R	20	3'	1.000	.950
925920-20-120-R	925910-20-120-R	20	10'	1.000	.950
925920-24-036-R	925910-24-036-R	24	3'	1.200	1.150
925920-24-120-R	925910-24-120-R	24	10'	1.200	1.150
925920-26-036-R	925910-26-036-R	26	3'	1.300	1.250
925920-26-120-R	925910-26-120-R	26	10'	1.300	1.250
925920-34-036-R	925910-34-036-R	34	3'	1.700	1.650
925920-34-120-R	925910-34-120-R	34	10'	1.700	1.650
925920-40-036-R	925910-40-036-R	40	3'	2.000	1.950
925920-40-120-R	925910-40-120-R	40	10'	2.000	1.950
925920-50-036-R	925910-50-036-R	50	3'	2.500	2.450
925920-50-120-R	925910-50-120-R	50	10'	2.500	2.450
925920-60-036-R	925910-60-036-R	60	3'	3.000	2.950
925920-60-120-R	925910-60-120-R	60	10'	3.000	2.950
925920-64-036-R	925910-64-036-R	64	3'	3.200	3.150
925920-64-120-R	925910-64-120-R	64	10'	3.200	3.150

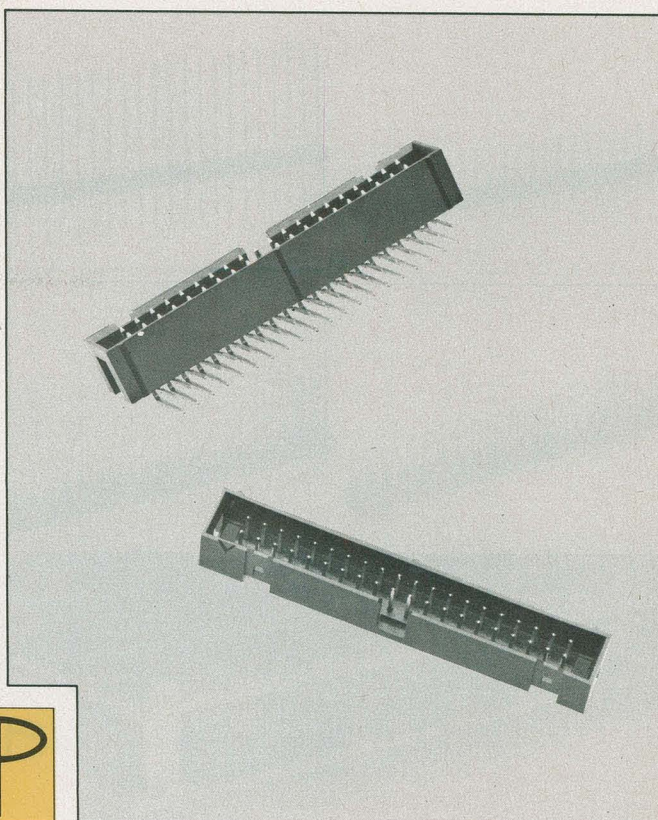
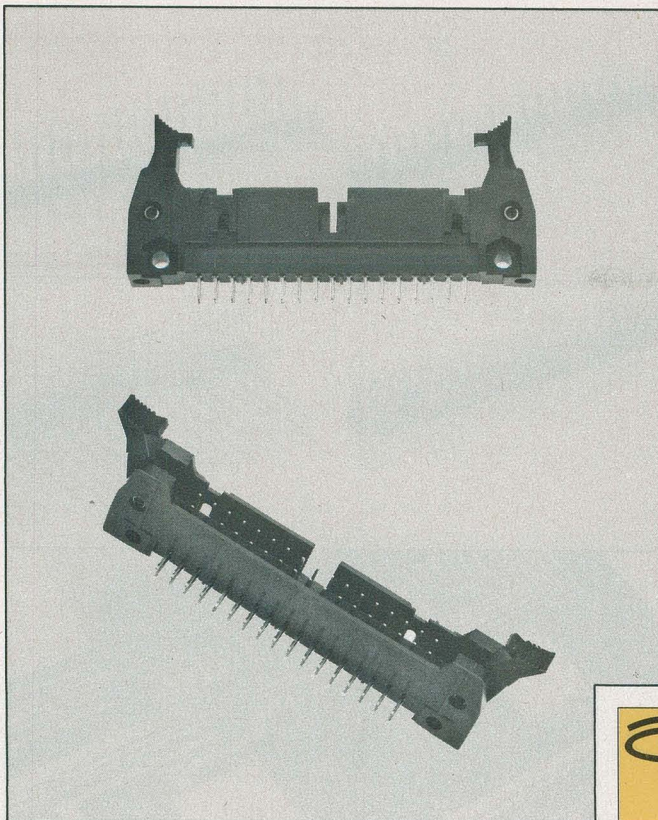


THE FIRST LOW COST IDC ASSEMBLY TOOLING

A P PRODUCTS is now offering "crunch-on" tooling that everyone can afford. Four different die sets are available to handle all sizes of DIP Plugs, D-Subminiatures, Sockets and Card-Edge Connectors. When this tool is used with the A P full line of IDC Connectors and Ribbon Cable, cable making becomes simple and economical.



IDC Tooling	
Part Number	Description
925980-R	Assembly Tool
925981-R	Socket Connector Die Set
925982-R	Dip Plug Die Set
925983-R	Card-Edge Connector Die Set
925984-R	D-Submin Connector Die Set



LATCH HEADERS FOR A POSITIVE LATCH AND EASY SOCKET REMOVAL

A P PRODUCTS offers 9 different sizes of latching male headers in both straight and right angle versions. These Latch Headers are shrouded on all four sides offering maximum pin protection. With both center and end keying slots designed into our Latch Headers, virtually all polarized sockets will fit. (The 10 pin has no center slot and only one end keying slot). All headers are designed to stand up off the board for easy cleaning.

In order to combine quality and economy, we selectively gold plated our contacts. This gives you the protection of gold on the contact area and the easy solderability of tin plating on the solder tails.

SPECIFICATIONS	
Materials	
Insulator	Thermoplastic Polyester 94 V-0
Contacts	Phosphor Bronze
Plating	10 millionths gold in contact area 100 millionths tin on solder tails (100 millionths nickel under both)

BOXED HEADERS THE LOW PROFILE ANSWER TO SHROUDED HEADER NEEDS

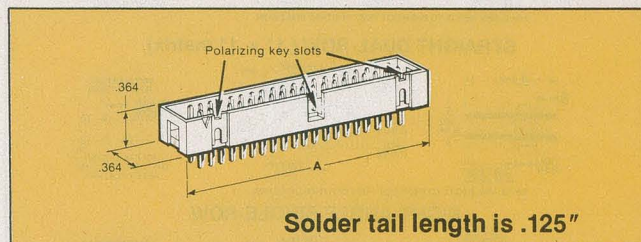
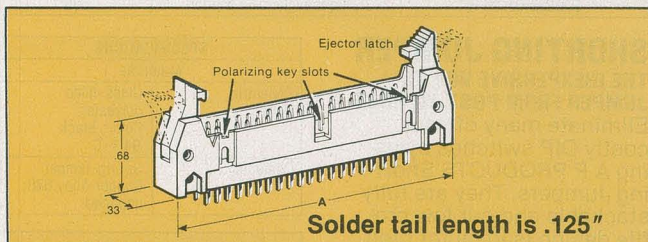
When board space is at a premium but you still need the protection of a fully shrouded header, A P PRODUCTS Boxed Headers are the answer. All sizes, in both straight and right angle are keyed, with polarizing in the center and on each end (the 10-pin header does not have the end keying slots). This means that virtually anybody's polarized socket will fit our headers.

We have selectively plated our contacts so you get the assurance of gold

plating where it's needed, on the contact area, but the economy of tin plating on the solder tail.

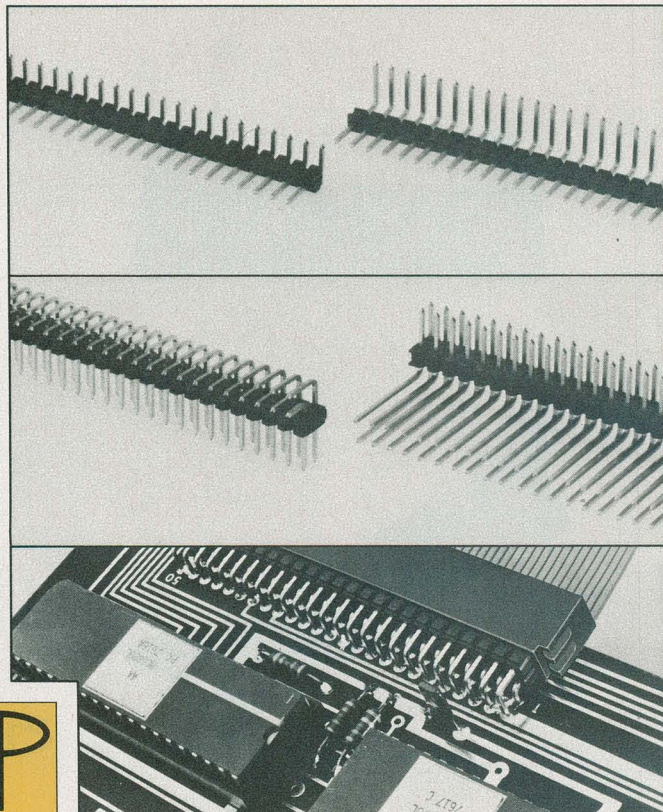
Our Boxed Headers are designed to stand up off the board to facilitate easier cleaning.

SPECIFICATIONS	
Materials	
Insulator	Thermoplastic Polyester 94 V-0
Contacts	Phosphor Bronze
Plating	10 millionths gold in contact area 100 millionths tin on solder tails (100 millionths nickel under both)



Part Number		Number of Contacts	"A" Dim.
Right Angle Latch Headers	Straight Latch Headers		
925220-10-R	925225-10-R	10	1.26"
925220-16-R	925225-16-R	16	1.56"
925220-20-R	925225-20-R	20	1.76"
925220-26-R	925225-26-R	26	2.06"
925220-34-R	925225-34-R	34	2.46"
925220-40-R	925225-40-R	40	2.76"
925220-50-R	925225-50-R	50	3.26"
925220-60-R	925225-60-R	60	3.76"
925220-64-R	925225-64-R	64	3.96"

Part Number		Number of Contacts	"A" Dim.
Right Angle Boxed Headers	Straight Boxed Headers		
925210-10-R	925215-10-R	10	.80"
925210-16-R	925215-16-R	16	1.10"
925210-20-R	925215-20-R	20	1.30"
925210-26-R	925215-26-R	26	1.60"
925210-34-R	925215-34-R	34	2.00"
925210-40-R	925215-40-R	40	2.30"
925210-50-R	925215-50-R	50	2.80"
925210-60-R	925215-60-R	60	3.30"
925210-64-R	925215-64-R	64	3.50"



You have a choice when it comes to A P PRODUCTS male headers. We offer double row headers already cut to length in 10 to 64 pin configurations. We also offer single and double row headers with 36 pins per row which can easily be cut

down to any length you need. Both styles come in straight and right angle versions and all are ideal for mating with A P PRODUCTS female headers or IDC Sockets.

SPECIFICATIONS	
Materials	
Dielectric	Thermoplastic Polyester 94 V-0
Posts	Full hard Copper Alloy 770
Finish	90/10 Solder plate

Part Number (2 per pkg.)			
Straight Male Strip Headers	Right Angle Male Strip Headers	Number of Contacts	"B" Dim.
923860-R	923870-R	2x5	.110"
923861-R	923871-R	2x8	.110"
923862-R	923872-R	2x10	.110"
923863-R	923873-R	2x13	.110"
923864-R	923874-R	2x17	.110"
923865-R	923875-R	2x20	.110"
923866-R	923876-R	2x25	.110"
923867-R	923877-R	2x30	.110"
923868-R	923878-R	2x32	.110"

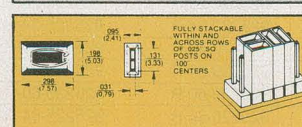
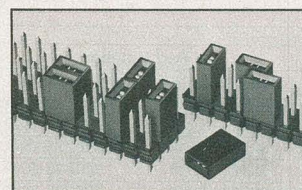
Part Number	Description	"B" Dim.
929834-01-36-R	1x36 Straight male header	.110"
929836-01-36-R	2x36 Straight male header	.110"
929835-01-36-R	1x36 Right angle male header	.110"
929838-01-36-R	2x36 Right angle male header	.110"
929834-05-36-R	1x36 Straight male header	.610"
929836-05-36-R	2x36 Straight male header	.610"
929835-03-36-R	1x36 Right angle male header	.605"
929838-03-36-R	2x36 Right angle male header	.605"

Eliminate many of your costly DIP switches by using A P PRODUCTS Shorting Jumpers. They are fully stackable and our low profile design is ideal for high density applications. These Shorting Jumpers mate with all standard .025" round or square posts on .100" centers.

Another feature of A P PRODUCTS Shorting Jumper is our unique C-spring contact. This gives a balanced force on the posts and a very low resistance.

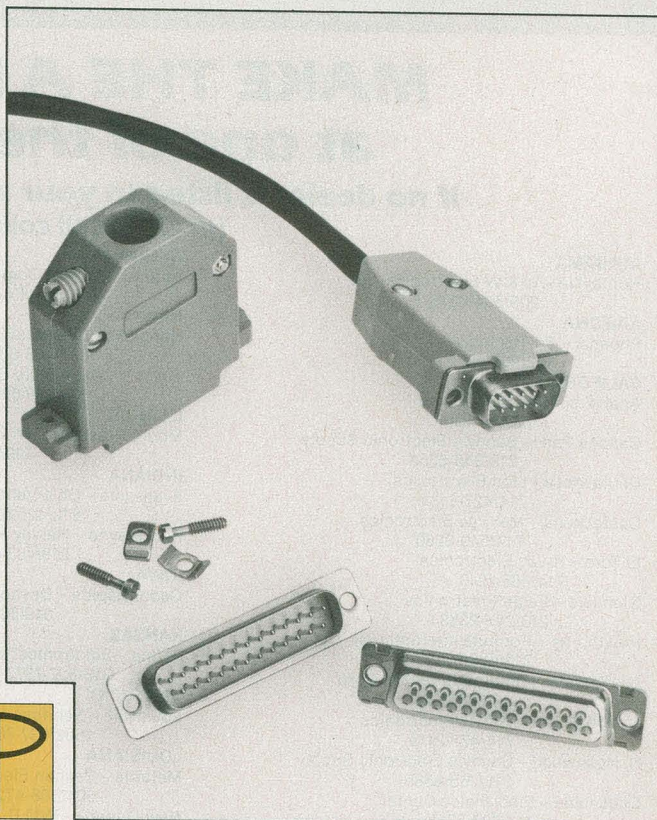
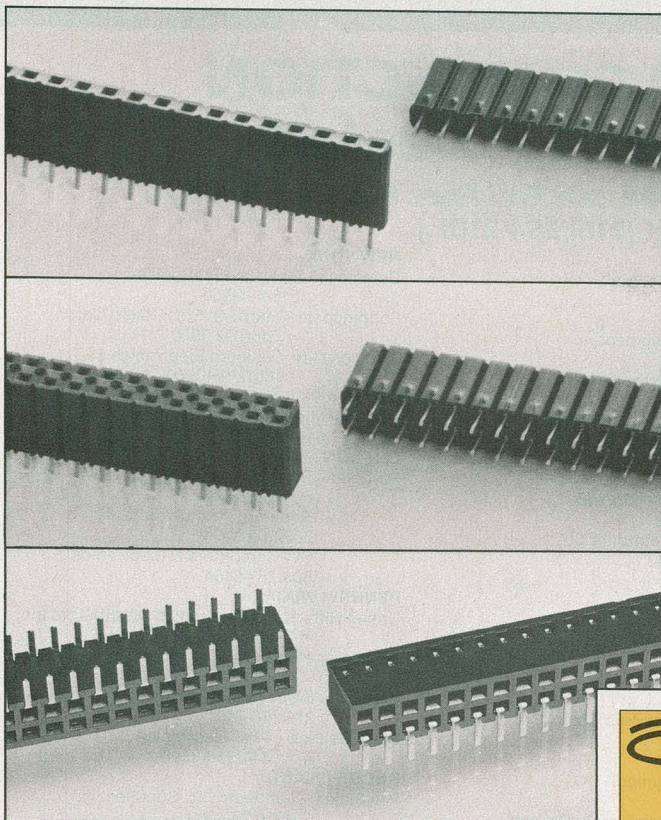
Part Number (10 per pkg.)	925250-R
-------------------------------------	-----------------

SPECIFICATIONS	
Materials	
Dielectric Body	Glass-filled polyester Color: Black 94 V-0
Contacts	Spring-temper Copper Alloy 688; unplated.

[illegible][illegible]

25-LB. MIN. REQ'D. TO PUSH OUT POST.

25-18 MIN. REFLD. TO PUSH OUT POST.



STRAIGHT AND RIGHT ANGLE FEMALE STRIP HEADERS

THE FEMALE CONFIGURATION FOR MATING WITH MALE HEADERS

Our Right Angle Female Headers are available in 10 to 60 pin configurations. The Straight Female Headers come with 36 pins per row (72 pins total for double row headers). These can easily be cut down to

any desired length. Both styles mate with .025" square or round posts on .10" centers.

SPECIFICATIONS (STRAIGHT)	
Materials	
Dielectric	Glass-filled Polyester 94 V-0
Contact Forks	Spring Temper Copper Alloy 770
Finish	90/10 Solder Plate

SPECIFICATIONS (RIGHT ANGLE)	
Materials	
Dielectric	Polyphenylene Sulphide 94 V-0
Contacts	Copper Alloy 725
Finish	90/10 Solder Plate

SOLDER D-SUBMIN THE IDEAL LIGHTWEIGHT, HIGH DENSITY CONNECTOR

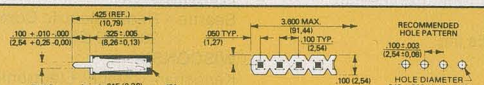
This connector guarantees proper polarization every-time and will mate with all compatible Mil-C connectors. Wire up to 20 AWG can be used in these solder cup contacts.

For maximum protection and cable strain relief use A P PRODUCTS D-Subminiature backshells. They are available in the same five

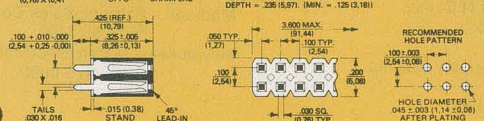
sizes as the connectors and are easily installed.

SPECIFICATIONS	
Materials	
Contacts	Phosphor bronze
Connector Shell	Steel; cadmium plated with chromate
Insulator	Nylon (rated 94 V-0)
Backshell	Glass-filled nylon (Rated 94 V-0)
Plating	20 millionths minimum gold over nickel

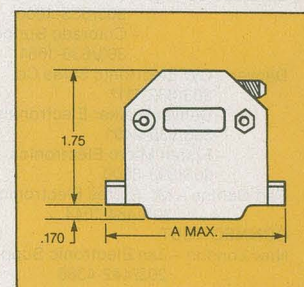
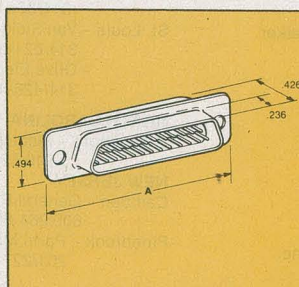
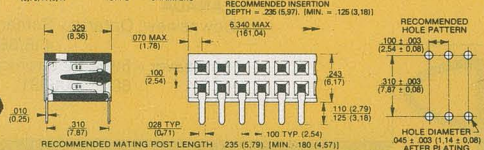
STRAIGHT SINGLE-ROW



STRAIGHT DUAL-ROW (.1" x .1" matrix)



RIGHT-ANGLE DUAL-ROW (.1" x .1" matrix)



Part Number	Description
929974-01-36-R	1x36 Straight female header
929975-01-36-R	2x36 Straight female header
925240-05-R	2x5 Right angle female header
925240-08-R	2x8 Right angle female header
925240-10-R	2x10 Right angle female header
925240-13-R	2x13 Right angle female header
925240-17-R	2x17 Right angle female header
925240-20-R	2x20 Right angle female header
925240-25-R	2x25 Right angle female header
925240-30-R	2x30 Right angle female header

Part Number	Description	"A" Dim.
925350-09-R	9 Contact male	1.21"
925370-09-R	9 Contact female	1.21"
925380-09-R	9 Contact backshell	1.27"
925350-15-R	15 Contact male	1.59"
925370-15-R	15 Contact female	1.59"
925380-15-R	15 Contact backshell	1.61"
925350-25-R	25 Contact male	2.09"
925370-25-R	25 Contact female	2.09"
925380-25-R	25 Contact backshell	2.15"
925350-37-R	37 Contact male	2.73"
925370-37-R	37 Contact female	2.73"
925380-37-R	37 Contact backshell	2.80"
925350-50-R	50 Contact male	2.63"
925370-50-R	50 Contact female	2.63"
925380-50-R	50 Contact backshell	2.70"

MAKE THE A P CONNECTION at one of these A P Dealers

If no dealer is listed in your area call Toll Free 800-321-9668
(In Ohio call collect (216) 354-2101.)

ALABAMA

Huntsville - W & W Electronics, Inc.
205/534-0376

ARIZONA

Phoenix - Tri-Tek Inc.
602/995-9352

CALIFORNIA

Anaheim - Ball Electronics
714/828-1310
Canoga Park - Sandy's Electronic Supply
213/346-8353

Chula Vista - Lion Electronics
714/427-6131

Costa Mesa - Mar Vac Electronics
714/540-3280

El Toro - R-Vac Electronics
714/586-1210

Glendale - Eagle Electronics
213/245-2338

Hawthorne - Formula International
213/679-5162

Los Angeles - International T.V. Corp.
213/388-0621

National City - Willy's Electronics
714/477-2119

N. Hollywood - Sandy's Electronic Supply
213/765-8585

Oceanside - Electronics Center
714/722-5855

Redwood City - HDB Electronics
415/368-1388

Sacramento - Zackit/Sacramento
916/446-3131

San Bernardino - Mac's Electronics
714/884-3187

San Jose - Quement Electronics
408/998-5900

San Luis Obispo - Mid-States Elect. Supply
805/543-2770

Santa Ana - Action Electronics
714/547-5169

Sunnyvale - Sunnyvale Electronics, Inc.
408/736-1324

Thousand Oaks - Sandy's Electronic Supply
213/889-1209

Torrance - S.E. Electronics
213/378-5277

COLORADO

Colorado Springs - Centennial Electronics
303/633-4666
- Colorado Springs Walker
303/636-1661

Denver - CW Electronic Sales Co.
303/832-1111

- Denver Walker Electronics
303/935-2401

- Fistell Micro Electronics
303/393-6000

Fort Collins - Mt. States Electronics
303/484-1044

CONNECTICUT

New London - Jan Electronic Supplies Inc.
203/442-4386

FLORIDA

West Palm Beach - Dolphin Electronic Supply Inc.
305/659-7166

GEORGIA

Atlanta - Atlanta Computer Mart
404/455-0647

HAWAII

Honolulu - Electrical Equipment
808/533-3884
- Honolulu Electronics
808/949-5564

ILLINOIS

Mount Prospect - Tri State Elect. Corp.
312/255-0600

INDIANA

Evansville - Ohio Valley Sound, Inc.
812/425-6173
Fort Wayne - Harvey's Electronic Ctr.
219/483-0113

IOWA

Cedar Rapids - Deeco, Inc.
319/365-7551

KANSAS

Salina - Electronics, Inc.
913/827-7377

KENTUCKY

Louisville - Peerless Electronic Equip. Co.
502/637-7677

LOUISIANA

Metairie - Pelican Electronics
504/888-4720

New Orleans - WM.B. Allen Supply Co., Inc.
504/525-8222

Shreveport - Industrial Electronic
318/222-9459

MARYLAND

Aberdeen - Harco Electronics, Inc.
301/838-7990

Baltimore - Modern Electronics Distributors, Inc.
301/282-5300

Churchville - Churchville Electronics
301/838-4983

Towson - Baynesville Electronics
301/823-0082

MASSACHUSETTS

Needham - YDI Electronic Corp.
617/449-1005

MINNESOTA

Minneapolis - ACME Electronics Inc.
612/338-4754

MISSOURI

Columbia - Alpha Labs
314/874-1514

St. Louis - Van Sickle Radio-Electronics, Inc.
314/621-5000

- Olive Electronics Inc.
314/426-4500

NORTH CAROLINA

Greensboro - Electronix of N.C. Inc.
919/855-6800

NEW JERSEY

Camden - General Radio Supply Co., Inc.
609/964-8560

Pinebrook - Parts Master Inc.
201/227-7797

NEW YORK

Commack - Spartan Electronics
516/499-9500

Farmingdale - Harrison Elec. Radio Corp.
516/293-7990

Johnson City - Unicorn Electronics
607/798-0260

OHIO

Marion - Mid-Ohio Electronics
614/383-1101

OREGON

Portland - Portland Radio Supply
503/228-8647
- Radar Electric Co., Inc.
503/232-3404
- SW Computers & Electronics
503/257-9464

PENNSYLVANIA

Drexel Hill - Kass Electronics Distributors Inc.
215/449-2300

Lancaster - Barbey Electronics
717/393-5637

Reading - Barbey Electronics
215/376-7451

State College - Alvo Electronics
814/238-0506

RHODE ISLAND

Pawtucket - Jabbour Elec. Supplies, Inc.
401/728-4600

TEXAS

Austin - Tinkertronics Inc.
512/926-4420

- Electrotex
512/454-0318

Dallas - Electrotex
214/243-0433

Houston - Electrotex
713/526-3456

San Antonio - Electrotex
512/735-9271

UTAH

Provo - Alpine Electronics
801/373-7372
- Central Utah Electronics Supply
801/373-7522

VIRGINIA

Annadale - Arcade Electronics, Inc.
703/256-4610

Roanoke - Peoples Electronic Supply, Inc.
703/342-8933

WASHINGTON

Seattle - Radar Electric Company, Inc.
206/282-2511

WISCONSIN

Kenosha - Chester Electronic Supply
414/658-4616

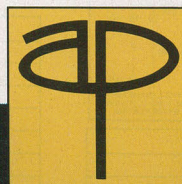
Madison - Schrenk Sales Company
608/255-7400

Milwaukee - Marsh Electronics, Inc.
414/475-6000

CANADA

Downsview, Ontario - Semad Electronics Ltd.
416/663-5650

Vancouver - Intek Electronics Ltd.
604/324-6831



A P PRODUCTS INCORPORATED

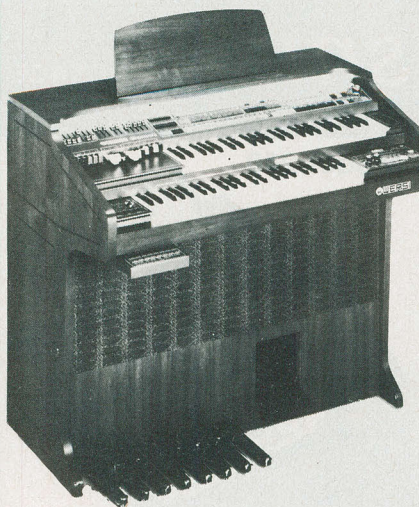
9450 Pineneedle Dr. • Box 540 • Mentor, Ohio 44061-0540

[216] 354-2101 • TWX: 810-425-2250

In Europe, contact A P PRODUCTS GmbH • Bäumlesweg 21 • D-7031 Weil 1 • West Germany

Phone: [07157] 62424 • TLX: 841 07 23384

A NEW STAR IS BORN!



The Wersi Comet opens the way to the fascinating world of music and electronics.

- Most powerful research and development in the organ industry
- Lowest price
- Fastest organ kit to build
- No technical experience needed
- Biggest sound in the smallest cabinet
- Easiest to play, highest technology, most economical. The unbelievable, new Wersi Comet!

Features: CX1 preprogrammable rhythm and accompaniment unit, the Wersi Sound Memory, multi-guitar group, piano section, couplers, incredible magic finger group including automatic chords, glissando, arpeggios, and many, many more.

Los Angeles, Cal. (213) 802-2891

(714) 739-4909

Lancaster, Pa. (717) 299-4327



- ☐ Free Organ Info.
- ☐ Free Piano Info.
- ☐ Complete WERSI Info.

WERSI

Dept. M 51, P.O. Box 5318

Lancaster, Pa. 17601

Call Toll Free: 800-233-3865

VOICE OPERATED SWITCH

continued from page 70

was built into a $4 \times 2 \times 1\frac{1}{2}$ -inch plastic "experimenter's box" with an aluminum front-panel (see Fig. 2), but any enclosure will do. The box we chose was, admittedly, almost too small, so positioning the battery, relay, and RANGE control had to be done with care.

Most of the components were mounted on a piece of perforated construction-board as shown in Fig. 3 and point-to-point wiring was used. A small piece of foam rubber was glued to the backside of the front panel so that it would press against the battery when the panel was screwed down. That was sufficient to hold the circuit board in place.

There is one thing you must watch for if you use a metal panel. You *MUST* insulate J2 from the panel. For most cassette recorders, remote switching is done in the positive supply, making both terminals of J2 "hot." Thus, if you do not insulate J2, you will cause a direct short across the recorder's supply. Of course, the easiest way to solve the problem would be to mount J2 somewhere on the plastic part of the box.

Little about the wiring is critical, with the exception bringing the output leads to the recorder. As you can see in Fig. 2, we used the cable from a defective mike for that. As an alternative, you can make up a couple of cables and terminate them with the appropriate miniature and subminiature plugs. That should work just as well provided that you use shielded cable for the mike lead.

You can, of course, modify the unit to suit your particular needs. For instance, you could mount a microphone cartridge directly in the box, making the whole thing even more compact unit. If your cassette recorder does not have a remote jack, you can easily add one by mounting a closed-circuit subminiature jack in a convenient place in the recorder's case and wiring it in series with the positive battery lead.

R-E

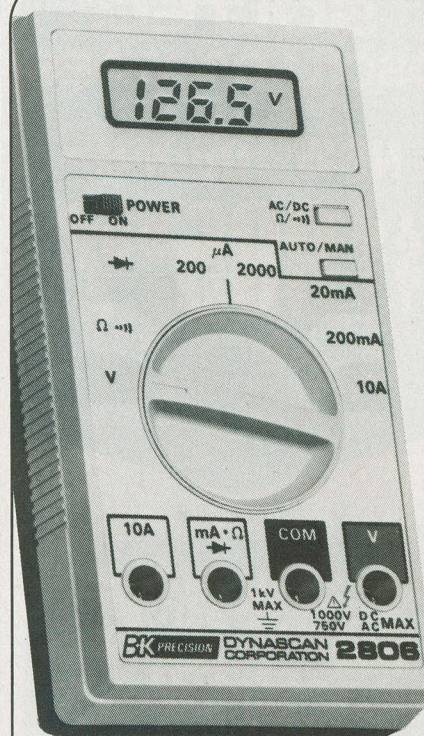
LOOK

What USO is doing for the people from your community!

When your community's young people are far away in the military, they're never very far from a USO. Around the world at nearly 175 locations, USO helps take your concern and caring to them on holidays and everyday. Crisis assistance, family help, classes, community projects and more help them know they haven't been forgotten.

Support USO through the United Way, OCFC, or local USO campaign.

New from B&K-PRECISION



Auto/manual ranging DMMs from \$75

Model 2806

- Autoranging on volts and ohms
- Manual ranging on amps
- 0.7% DC accuracy
- 500 hour battery life
- Continuity test beeper
- Diode check
- Transient and overload protected
- High energy fuse

Model 2807 \$115

Manual or autoranging on volts and ohms with 0.5% DC accuracy.

Model 2816 \$150

Same features as 2807 with 0.25% DC accuracy.

For more information contact your
B&K-PRECISION
distributor or write for specifications.

B&K PRECISION

**DYNASCAN
CORPORATION**

6460 West Cortland Street
Chicago, Illinois 60635 • 312/889-9087
International Sales, 6460 W. Cortland St., Chicago, IL 60635
Canadian Sales, Atlas Electronics, Ontario
South and Central American Sales,
Empire Exporters, Plainville, NY 11803

NOVEMBER 1983

CIRCLE 77 ON FREE INFORMATION CARD

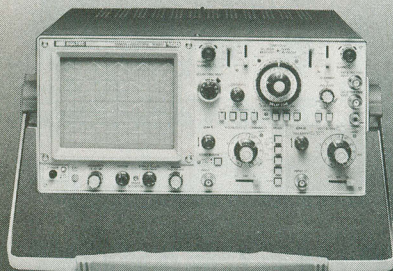
99

SOLTEC® OSCILLOSCOPES

NOW 100 MHz
\$1,995.00!

- 1500 hrs. MTBF
- Glass epoxy circuit boards
- 2 year warranty on all parts and labor

MODEL 5100



- 100 MHz
- 2mV Sensitivity
- 4 Channels
- 8 Traces
- Calibrated time base delay

No other manufacturer offers comparable quality, design features and proven performance in a 100 MHz Scope at this price. Let us prove it to you!

Two Probes Included

SOLTEC® OSCILLOSCOPES

Model No.	Description	Price
5100	100 MHz, Quad Trace, Portable	\$1,995.00
560	60 MHz, Triple-Trace, Portable	1,695.00
540P	40 MHz, Triple-Trace, Portable	1,295.00
540D	40 MHz, Triple-Trace, Desk Top	1,295.00
540M	40 MHz, Triple-Trace with Built-in DMM, Portable	1,995.00
540C	40 MHz, Triple-Trace with Built-in Counter/Timer, Portable	1,995.00
530	30 MHz, Dual-Trace, Portable	895.00
520	20 MHz, Dual-Trace, Portable	695.00
515-2	15 MHz, Dual-Trace, Portable	595.00
515-1	15 MHz, Single-Trace, Portable	495.00

CALL NOW

for the name of the distributor in your area and a color catalog with full details TOLL FREE

800 - 423-2344

For further details call:

SOLTEC DISTRIBUTION

P.O. Box 818, Sun Valley, California 91353

In California call (213) 767-0044

Outside California: 800-423-2344

HI-FI SOUND CONVERTER

continued from page 50

haps the buzz of video from the project. Adjust coil L1 for maximum volume and then adjust L3 for the cleanest sound quality. Note that L3's tuning may be quite broad, and that the best results will be obtained over a range of several turns. That's normal, and all you need do is to center the adjustment. Repeat the adjustments several times for best results.

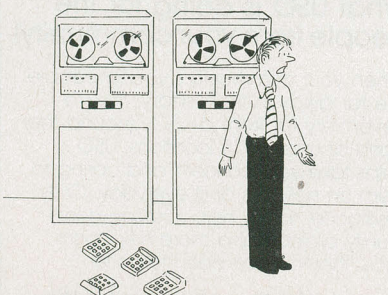
Try moving the RG-174 cable around, noting the volume of the sound. With some sets you will get great results with the cable taped onto the outside of the cabinet. With others you may have to leave the cable very near the sound section. Once you have found a convenient location, turn off the TV, unplug it, and secure the cable in place. A dab of RTV (silicone bathtub-sealer) is ideal for that. Replace the back cover of the TV.

Turn your TV set back on and tune to an unused channel. Adjust the fine tuning knob so that all you hear from the converter is noise. Adjust potentiometer R5 so that the noise is muted. Then turn back to the active channel and the sound should return. Note that this adjustment is also not too critical; the muting circuit doesn't have a sharp threshold like the one in a CB receiver.

Using the converter

Using the TV Sound Converter is a snap—once it is set up, no more attention is required. Turn on your TV and carefully adjust its fine-tuning control for the best possible sound and picture quality for each station in your area. Tune to unused channels, and adjust the fine tuning so that no sound from adjacent channels can be heard. That ensures that the converter's muting function will work properly. Then adjust the bass, treble, and volume controls to suit your taste. That's all there is to it!

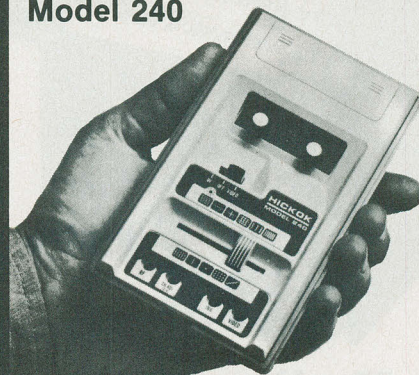
You're now all set to enjoy great sound! With a good quality 8- or 16-ohm speaker attached, you'll probably be amazed at how good TV can sound, whether you're watching a movie, a sporting event, a musical feature, or even playing a videogame. And you'll probably wonder why you didn't hear about anything like this converter sooner! **R-E**



"Alright—what wise guy that fed it that sex program?"

BIG PERFORMANCE small PACKAGE

Model 240



Video Generator

- Video output for all VCR, CCTV and Monitor Applications ± 1 volt into 75 Ω load
- RF output: CH 2, 3, 4
- Scope trigger output for V or H sync
- 10 step gray-scale staircase signal for video circuit analysis
- 10 bar and 3 bar gated rainbow pattern
- 8 other dot, bar and line patterns
- Operates from 2 std. 9V batteries or 115VAC
- Single slide switch control
- Complete with test leads, protective cover, AC adapter, comprehensive instruction manual

PRICED UNDER \$200.
THE 240 DOES SO MUCH
FOR SO LITTLE!!



THE HICKOK ELECTRICAL INSTRUMENT CO.
10514 Dupont Avenue • Cleveland, Ohio 44108
(216) 541-8060 • TWX: 810-421-8286

CIRCLE 85 ON FREE INFORMATION CARD

NEW IDEAS

Low-battery warning

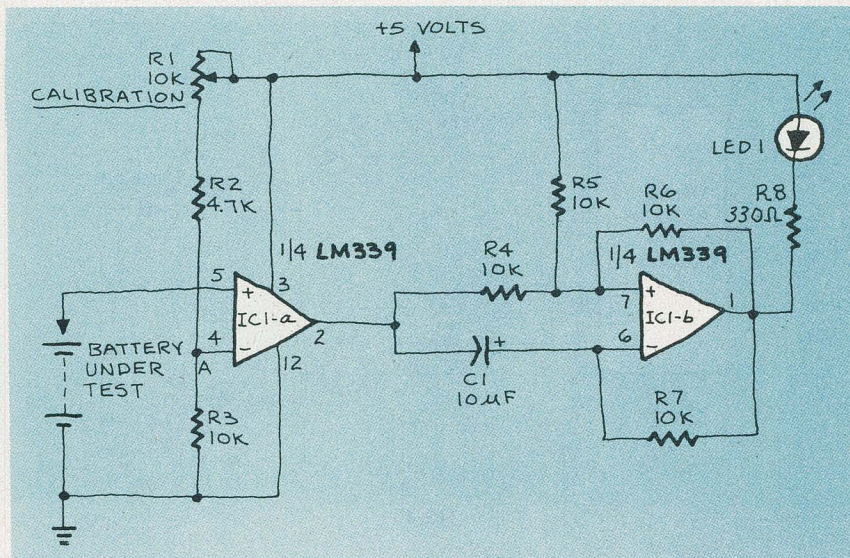


FIG. 1

WHEN WORKING WITH LOW-POWER DEVICES, the use of a battery back-up becomes practical, and in some instances important. Nowhere is that more true than in the case of non-volatile RAM (Random Access Memory). But batteries have a limited life span and their failure, if not detected, could have catastrophic results in the event that the main power source is disconnected from a memory device. After all, without some source of power the contents of the memory will be lost forever.

The circuit discussed here, and shown in Fig. 1, was designed to help prevent such an occurrence. It constantly monitors the condition of the batteries and signals if their voltage falls below a certain preset value. Use of a circuit such as this is especially important if carbon, alkaline, or nickel-cadmium batteries are used. Those devices have a relatively short shelf-life. What's more, they discharge relatively quickly.

Turning to the circuit itself, a voltage

divider consisting of R1, R2, and R3 is used to set the input reference voltage below which the batteries are to be replaced. That reference voltage, at point A, is varied by R1. With the voltage divider shown in Fig. 1, a range of 2 to 3.5 volts is possible.

When the battery voltage drops below that at point A, the output of IC1-a, $\frac{1}{4}$ of a LM339 quad comparator, switches from high to low. That triggers IC1-b, which is configured as an astable multivibrator.

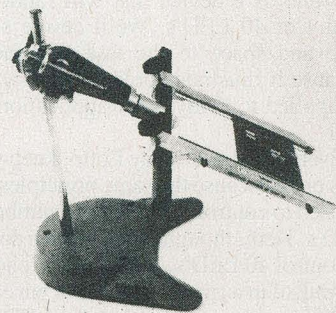
Feedback resistors R6 and R7, coupled with capacitor C1, determine the time constant of the multivibrator. The output from IC1-b is connected to LED1 through dropping resistor R8. With the circuit values as shown, the LED will flash at a rate of 3 Hz.

Although this circuit was designed specifically to monitor RAM back-up batteries, it can of course be modified for use in just about any application where the condition of a battery must be found.—William T. Surgeson

NEW IDEAS

This column is devoted to new ideas, circuits, device applications, construction techniques, helpful hints, etc.

All published entries, upon publication, will earn \$25. In addition, Panavise will donate their model 333—The Rapid Assembly Circuit Board Holder, having a retail price of \$39.95. It features an eight-position rotating adjustment, indexing at 45-degree increments, and six positive lock positions in the vertical plane, giving you a full ten-inch height adjustment for comfortable working.



I agree to the above terms, and grant **Radio-Electronics** Magazine the right to publish my idea and to subsequently republish my idea in collections or compilations of reprints of similar articles. I declare that the attached idea is my own original material and that its publication does not violate any other copyright. I also declare that this material has not been previously published.

Title of Idea

Signature

Print Name

Date

Street

City

State

Zip

Mail your idea along with this coupon to: **New Ideas Radio-Electronics**, 200 Park Ave. South, New York, NY 10003



"I had my home computer do my taxes. It cheated the government out of ten thousand bucks and set me up as the fall guy."

HOBBY CORNER

Lotto device

EARL "DOC" SAVAGE, K4SDS, HOBBY EDITOR

STATE-RUN LOTTO-TYPE LOTTERIES have become very popular over the last several years. In those games the player picks six lucky numbers between 1 and 40. If those numbers are also selected in the weekly drawing, the player wins all or part of a "jackpot." Some of those jackpots can be quite large; recently a Pennsylvania man won 7-million dollars in that state's game. Of course if the numbers are not chosen the state keeps the player's wager.

The reason we're bringing all of that up is that we recently received a letter from George Rates (NY), who wants a device to help him pick his lucky numbers. What he wants is a device that will randomly light 1 of 40 LED's. We'll devote some time and space to the task this month because it illustrates procedures that can be applied to many other applications as well.

Even if you don't play Lotto, keep your eyes open because the same principles can be used to control any practical number of LED's. Here, though, we'll build a device to control 40 LED's, which we've chosen to think of in terms of four sets of ten each. Of course, you can arrange the LED's in any straight or mixed pattern you desire.

Figure 1 shows a 74145 BCD-to-decimal decoder IC. It has ten output lines that go low sequentially as it is addressed from

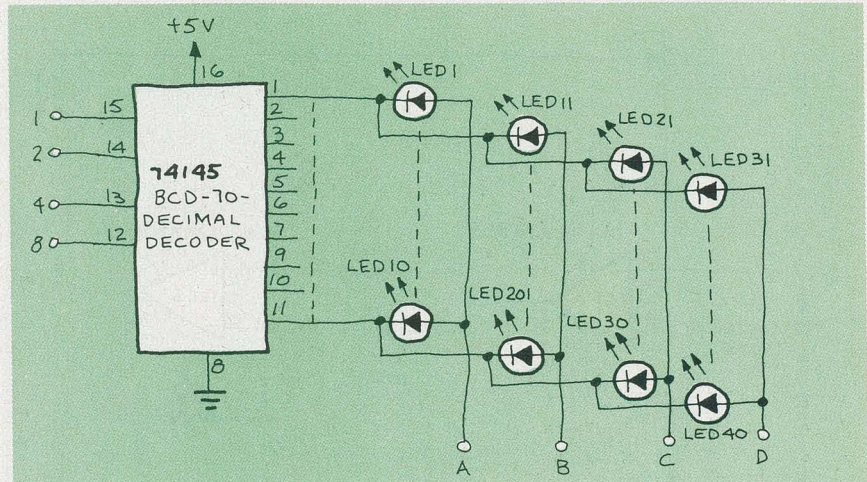


FIG. 1

zero to nine. (Only the first and last lines are shown but the other 8 are connected the same way.) Note that each output line is connected to 4 LED's. In addition, one LED in each set is connected to a line (labeled A, B, C, and D).

Now, if we put +5-volts DC on line A, any of the ten LED's on that line will light when the address line to it from the 74145 goes low. The same applies to the LED's attached to lines B, C, and D.

So far, so good; but we need something to provide the addresses to that 74145. That is taken care of in Fig. 2. It is nothing more than a 555 oscillator driving a 7490 decade counter. Open S1 and the 555 outputs pulses at pin 3. In turn, the 7490 counts those pulses in groups of ten and outputs repeated counts of one to ten (in BCD, of course).

Now, let's test what we have. Connect the output of the 7490 to the input of the 74145. Apply 5 volts to line A and press

S1. You should not see anything happening; the values of R1, R2, and C1 were chosen to produce fast pulses and the LED's will be flashing so fast you don't see them. As soon as you release the switch, however, the flashing stops and one of the LED's remains on.

You can slow the rate of the flashes to see what's happening by substituting a larger capacitor for C1. If you do so, be sure not to leave it there permanently because the "random" LED that remains lighted is only random when the LED's flash so fast that you can't stop it where you wish.

Let's stop for a moment and see where we stand. We have one set of ten LED's that flash sequentially so fast that you can't predict which will be on when you release the switch. That's fine, but we're not finished; we must get the other 30 LED's into the act.

Using all 40 LED's is only a matter of switching the 5 volts from line to line. Of course, the switching must be timed just right in order to energize a line as soon as the previous line has finished flashing. There are many ways that can be done, but we're going to use the method shown in Fig. 3.

Note in Fig. 3 that pins 2 and 3 of the 7404 are tied together to pin 8. We want only a count of four and doing that resets the counter to zero when it reaches four. If you are wondering why it resets at four when you need four counts, remember that the count does not start at one, but at zero instead.

AN INVITATION

To better meet your needs, "Hobby Corner" has undergone a change in direction. It has been changed to a question-and-answer form. You are invited to send us questions about general electronics and its applications. We'll do what we can to come up with an answer or, at least, suggest where you might find one.

If you need a basic circuit for some purpose, or want to know how or why one works, let us know. We'll print those of greatest interest here in "Hobby Corner." Please keep in mind that we cannot become a circuit-design service for esoteric applications; circuits must be as general and as simple as possible. Please address your correspondence to:

Hobby Corner
Radio-Electronics
200 Park Ave. South
New York, NY 10003

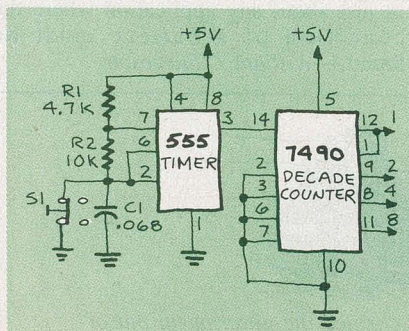


FIG. 2

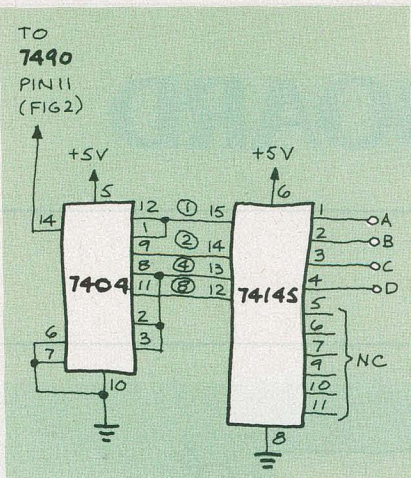


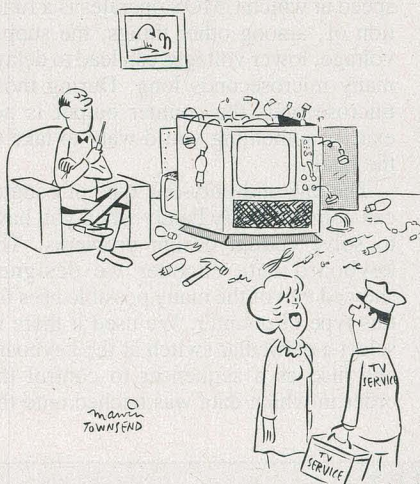
FIG. 3

For the same reason, we are using only the first four output pins of the 74145. In order to synchronize the lines with the LED's, be sure that you drive the 7404 with a signal from pin 11 of the 7490, as shown in Fig. 3.

Now we are all set but for one thing: The output of the 74145 takes the selected line to ground and we want it taken high (remember that we want a positive voltage on the LED lines). That is the reason for the 7404, a hex inverter. It changes the high's to low's and vice-versa. So, we have the selected line going high as we need.

Connect the A, B, C, and D lines from the 7404 to the like-labeled lines from the LED's and that's all there is to it. The flashes run through the first ten LED's, then the second ten, and so on, returning, of course, to the first set of ten after the fourth.

Well, George, get started building. When you are through, each push of the switch will leave a randomly selected LED lighted. Don't forget that you can arrange the LED's in whatever order best suits your needs or whims. **R-E**



"It shouldn't take you long to repair it. Elmo has already laid out all the ground-work for you."

The professional breadboard. (For professional, hobbyist or student.)

Global Specialties' PB-203A Proto-Board®

The solderless breadboard that set the industry standard for speed, versatility and convenience. With a capacity up to twenty-four 14-pin DIPs and three regulated power supplies (one fixed, two variable), PB-203A features a large array of sockets and bus strips that emulates standard PC layouts. Permitting instant insertion and removal of virtually any component from the largest DIP to the smallest discretes. Helping you design, assemble, test and modify circuits almost as fast as you can think! And built with professional durability, for all types of applications.

Our PB-203A. Only \$174* (kit \$149.95*) or PB-203 with single 5V supply, \$133.* One more reason so many people say "Proto-Board" for solderless breadboarding.



GLOBAL SPECIALTIES CORPORATION

70 Fulton Terr., New Haven, CT 06509 (203) 624-3103, TWX 710-465-1227
OTHER OFFICES: San Francisco (415) 648-0611, TWX 910-372-7992, Europe: Phone Saffron-Walden 0799-21682, TLX 817477
Canada: Len Finkler Ltd., Downsview, Ontario

Call toll-free for details **1-800-243-6077** During business hours

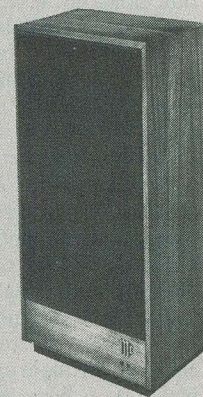
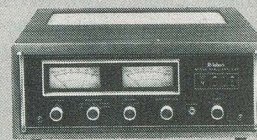
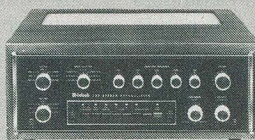
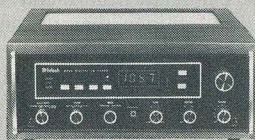
*Suggested U.S. resale. Prices, specifications subject to change without notice. © Copyright 1981 Global Specialties Corporation.

CIRCLE 96 ON FREE INFORMATION CARD

FREE

McIntosh STEREO CATALOG and FM DIRECTORY

Get all the newest and latest information on the new McIntosh stereo equipment in the McIntosh catalog. In addition you will receive an FM station directory that covers all of North America.



**SEND
TODAY!**

McIntosh Laboratory, Inc.
East Side Station P.O. Box 96
Binghamton, N.Y. 13904-0096

RE

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

If you are in a hurry for your catalog please send the coupon to McIntosh.
For non rush service send the Reader Service Card to the magazine.

CIRCLE 93 ON FREE INFORMATION CARD

THE DRAWING BOARD

Working with counters

ROBERT GROSSBLATT

IC-FABRICATION TECHNOLOGY HAS COME a long way since the first IC rolled off the production line a mere twenty or so years ago. Component density has gone from four transistors on the early chips to over four hundred thousand transistors on current ones. These mind boggling numbers have led to all sorts of good things—from five-dollar microprocessors to blister-packed digital watches sold next to the canned soup in the supermarket. The result of all this on someone (like me) who occasionally likes to re-invent the wheel to solve circuit problems has been quite extraordinary.

I've had to re-define the wheel.

What is new, expensive, and exotic today is most definitely cheap and ho-hum tomorrow. I can remember using loads of power-gobbling gates and flip-flops to build counters. Today that approach to a circuit design would be ridiculous because the array of features in available MSI (*Medium Scale Integration*) counters can take care of any design problem you can imagine. Counters have to be considered a basic building block of digital design—in other words, a one IC addition to a circuit.

Now, the word "counter" takes in a lot of territory—anything that does first one thing and then another in a pre-arranged sequence can be called a counter. Just about the only thing they have in common is that they need a power supply and some sort of clock. There are lots of ways you could divide them up but since we're calling them a basic building block, we'll make a basic two divisions—counters with a one-and-only-one type of output and those with encoded outputs.

Every logic family has its own array of counters and for our purposes, anything we say about the counters in one family will be more or less true of the counters in any other family. We'll restrict our discussion to CMOS counters since we're more interested in finding out how to use them than in chopping the top off the package and looking at the silicon.

The 4017 is a good example of a counter that has only one output decoded at a time. It has ten outputs and they go high one at a time in fixed sequence as long as the ENABLE and RESET pins are held at ground. A high on the ENABLE pin will disable the clock input and the counter will ignore incoming clock pulses. A high

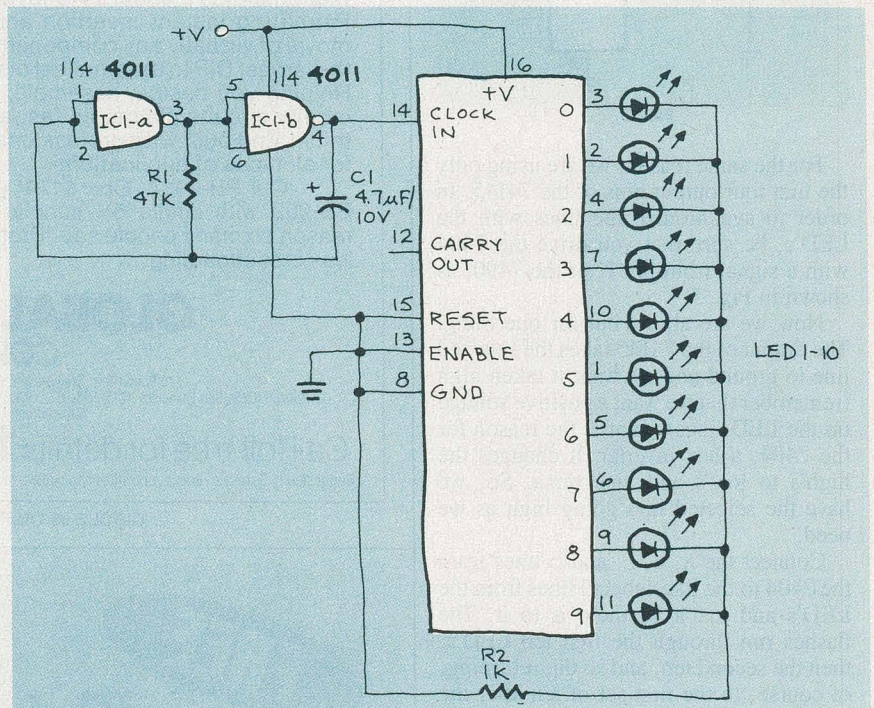


FIG. 1

on the RESET pin will make the "0" output go high; it will stay that way until the RESET pin is grounded again. There's also a "carry" output that divides the input clock by ten—it's high for counts zero through four and low for counts five through nine. This IC is really a shift register with a few added bells and whistles. There are, however, some interesting things we can learn from it and some extremely useful things that it can do when we put it to work for us.

First of all, this is a synchronous counter. That means that all the internal flip-flops are triggered by the incoming clock at the same time. The other possible arrangement is called a ripple counter, meaning that the internal clocking takes place like a row of dominoes—each stage triggers the next stage. Ripple counters are cheaper to make; but they're much slower than synchronous ones since stage changes happen in serial, rather than pa-

rallel, fashion. They will also temporarily output incorrect counts while the dominoes are still falling. That glitchy period is euphemistically called the "settling time" but it would be more accurate to call it the time when the output of the counter was just plain wrong. Since the speed at which CMOS operates is a function of, among other things, the supply voltage, lower voltages can lead to delays many microseconds long. During those microseconds the counter output is not exactly something you'd want to take to the bank.

The one-and-only-one type of counter can come in really handy when you have to solve certain design problems. The keyboard data encoder we designed showed two of the many possible uses for this type of counter. We used it there to select a particular switch at the keyboard and also as a sequencer to control the order in which data was latched onto the

TABLE 1

Operation	Propagation Delay	Pulse Width	Transition Time
Decoded output	500 nanoseconds	200 nanoseconds	300 nanoseconds
Reset	450 nanoseconds	200 nanoseconds	250 nanoseconds

bus. That is, of course, by no means all it's good for.

The best way to understand how the IC is used is, naturally enough, to actually use it. Since the 4017 has outputs that sequence one after another, probably the most basic circuit we can build is the sequencer shown in Fig. 1. We're using one half of a 4011 to make a simple clock we can use to drive the 4017. Any other oscillator would be just as good. The frequency of the 4011 clock follows the form $F = 1/1.4RC$. Since we want to be able to see the 4017 outputs in action, we'll pick values for the clock components that slow it down enough for us to watch things happen. The values shown will give a clock frequency of about 3 Hz—a nice compromise between visibility and impairment.

Everything else in the circuit is straightforward. By tying both the ENABLE and RESET pins to ground, the 4017 will count from zero to nine over and over again. Now, that isn't the most exciting thing I've ever seen but even this circuit has some important real-world uses. What you're looking at is a one-IC method of delaying clock pulses by a time period exactly equal to N clock pulses. All you have to do is route your clock to the input of the 4017 and pick off whichever phase-shifted output you want. Of course your input clock will have to be running ten times faster than the frequency you want to see at the output, but that's not much of a problem.

We can spice things up even more by using the ENABLE and RESET pins. Tying the ENABLE pin to a particular output means that the 4017 will count to a certain number and then stop. Doing the same thing with the RESET pin will give you a really down-and-dirty method of frequency division. Since the IC will reset to zero whenever the selected output goes high, any of the chip's outputs in sequence before the selected one will go high at a rate equal to f/N where f is the input clock frequency and N is the number you're dividing by.

Someone once said that there's no such thing as a free lunch and that applies here as well as anywhere. While it's obviously true that you can divide a clock down this way, it's also unfortunately true that you're paying a price for simplicity. First, the duty cycle of the output will be something like $1/N$. This makes sense because the outputs go high for one full cycle of the input clock and remain low for the rest of the time. I said "something like $1/N$ " because there's a certain amount of uncertainty that's caused by the weirdness that goes on when the selected output goes high and the IC resets. That leads to the second price we have to pay.

When you operate the IC at 5 volts, the propagation delay (the time it takes for the IC to change to a new state) from one output to the next is about 500 nanoseconds. This means that there will

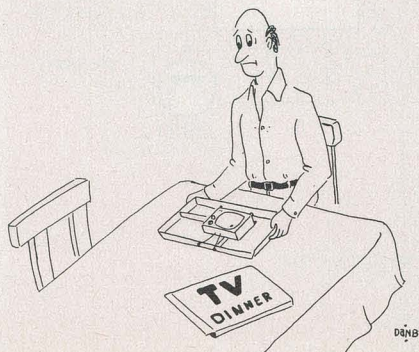
be a 500-nanosecond delay between the time an input pulse is detected and the IC puts a high on the next output in sequence. Let's assume we have the RESET pin tied to output 4 and output 3 is high. Along comes the next input clock pulse—it's detected and the internal machinery of the IC starts to decode it. When that operation is finished it simultaneously turns off output 3 and turns on output 4 (remember that this is a synchronous counter). So far so good.

When output 4 goes high, it brings the RESET pin high and causes the IC to turn off output 4 and put a high on pin 3—the first output in its sequence. The problem crops up because the 4017 features asynchronous reset. That means that reset takes place whenever the RESET pin is brought high. In an IC with synchronous reset, the reset operation wouldn't happen until the next clock pulse arrived at the input. The 4017 is counting as a synchronous counter but reset is happening in a ripple fashion. Our problem is that the IC ignores incoming clock pulses when the RESET pin is high as well as during the entire reset operation. A quick look at Table 1—which shows us the characteristic operational times for a 4017 operating from 5 volts—illustrates exactly what the problem is.

In the best of all possible worlds, therefore, there's a built-in period of almost 1 microsecond ($500 + 450$ nanoseconds) during which the 4017 is performing its reset operation. We have to wait for the selected output to be decoded and then twiddle our thumbs while the reset operation is carried out. Since the clock input is disabled half this entire time (during reset), we'd better make sure that no clock pulses show up at the input because they're going to be ignored. The price, therefore, that we're paying for down-and-dirty frequency division is a cutback in the maximum input frequency we can have and the possibility of glitches in the count.

Next month we'll see how to add synchronous reset and take care of these other problems by a little creative gating. We'll also start designing a circuit that will not only divide frequencies by any number we want, but is keyboard-programmable as well.

R-E



AUDIO KITS POWER AMPLIFIERS MOSFET



120 WATT
RMS (Mono)

Model UP70
\$199.95

ILP MOSFET power amplifiers are the logical choice for superb performance, compact size, excellent design, ease of assembly, and bargain prices! All models use famous ILP audio power amplifier modules, factory pre-assembled with bonded heat-sink and tested. Assembly is quick, easy, and assured. Each model features an ILP toroidal power transformer: half the weight and size of conventional transformers, toroids are also much quieter. ILP MOSFET power amps give no-compromise state-of-the-art performance: frequency response 15Hz - 100kHz (-3db), harmonic distortion 0.005% (1kHz), signal-to-noise ratio 100db, slew rate 20V/ps. Each kit mounts into a precision die-cast aluminum chassis. Like all ILP products, MOSFET power amp kits carry a five year limited warranty. Also available: MODEL UP60 60 watts RMS MOSFET amplifier \$159.95. Available direct and from selected dealers. Write for details.

CALL TOLL-FREE TO ORDER 800-833-8400

In New York call (716) 874-5510.

Mail orders accepted. VISA, Mastercard or checks.

GLADSTONE ELECTRONICS, INC.

1585 Kenmore Avenue Buffalo, New York 14217

In Canada: Gladstone Electronics, Toronto 800-268-3640

CIRCLE 71 ON FREE INFORMATION CARD

TOROIDAL Power Transformers



TYPE	SERIES No	SECONDARY Volts	RMS Current	TYPE	SERIES No	SECONDARY Volts	RMS Current
50VA 80 x 35 mm (3.1 x 1.4 in) 0.9 Kg (2.0 lbs) Regulation 13% \$19.95	2X010	6 + 6	4.16	225VA 110 x 45 mm (4.3 x 1.8 in) 2.2 Kg (4.9 lbs) Regulation 7% \$31.95	6X012	12 + 12	9.38
	2X011	9 + 9	2.77		6X013	15 + 15	7.50
	2X012	12 + 12	2.08		6X014	18 + 18	6.25
	2X013	15 + 15	1.66		6X015	22 + 22	5.11
	2X014	18 + 18	1.38		6X016	25 + 25	4.50
	2X015	22 + 22	1.13		6X017	30 + 30	3.75
	2X016	25 + 25	1.00		6X018	35 + 35	3.21
	2X017	30 + 30	0.83		6X025	45 + 45	2.50
	2X028	110	0.45		6X033	50 + 50	2.25
	2X029	220	0.22		6X028	110	2.04
80VA 90 x 30 mm (3.5 x 1.2 in) 1 Kg (2.2 lbs) Regulation 12% \$21.95	2X030	240	0.20		6X029	220	1.02
	3X010	6 + 6	6.64		6X030	240	0.93
	3X011	9 + 9	4.44	300VA 110 x 50 mm (4.3 x 2 in) 2.6 Kg (5.7 lbs) Regulation 6% \$35.95	7X013	15 + 15	10.00
	3X012	12 + 12	3.33		7X014	18 + 18	8.33
	3X013	15 + 15	2.66		7X015	22 + 22	6.82
	3X014	18 + 18	2.22		7X016	25 + 25	6.00
	3X015	22 + 22	1.81		7X017	30 + 30	5.00
	3X016	25 + 25	1.60		7X018	35 + 35	4.28
	3X017	30 + 30	1.33		7X026	40 + 40	3.75
	3X028	110	0.72		7X025	45 + 45	3.33
	3X029	220	0.36		7X033	50 + 50	3.00
	3X030	240	0.33		7X028	110	2.72
120VA 90 x 40 mm (3.5 x 1.6 in) 1.2 Kg (2.6 lbs) Regulation 11% \$24.95	4X010	6 + 6	10.00		7X029	220	1.36
	4X011	9 + 9	6.66		7X030	240	1.25
	4X012	12 + 12	5.00	500VA 140 x 60 mm (5.5 x 2.4 in) 4 Kg (8.8 lbs) Regulation 4% \$47.95	8X016	25 + 25	10.00
	4X013	15 + 15	4.00		8X017	30 + 30	8.33
	4X014	18 + 18	3.33		8X018	35 + 35	7.14
	4X015	22 + 22	2.72		8X026	40 + 40	6.25
	4X016	25 + 25	2.40		8X025	45 + 45	5.55
	4X017	30 + 30	2.00		8X033	50 + 50	5.00
	4X018	35 + 35	1.71		8X042	55 + 55	4.54
	4X028	110	1.09		8X028	110	4.54
	4X029	220	0.54		8X029	220	2.27
	4X030	240	0.50		8X030	240	2.08
160VA 110 x 40 mm (4.3 x 1.6 in) 1.8 Kg (4.0 lbs) Regulation 8% \$27.95	5X010	9 + 9	8.89	625VA 140 x 75 mm (5.5 x 3 in) 5 Kg (11.0 lbs) Regulation 4% \$56.95	9X017	30 + 30	10.41
	5X012	12 + 12	6.66		9X018	35 + 35	8.92
	5X013	15 + 15	5.33		9X026	40 + 40	7.81
	5X014	18 + 18	4.44		9X025	45 + 45	6.94
	5X015	22 + 22	3.63		9X033	50 + 50	6.25
	5X016	25 + 25	3.20		9X042	55 + 55	5.68
	5X017	30 + 30	2.66		9X028	110	5.68
	5X018	35 + 35	2.28		9X029	220	2.84
	5X026	40 + 40	2.00		9X030	240	2.60
	5X028	110	1.45				

ILP toroidal transformers are half the weight and height of standard laminated transformers. Supplied with mounting kit. 5 year limited warranty. Trade and OEM enquiries welcome. Note: Regulation - all voltages quoted are full load. Add regulation figure to secondary voltage to obtain full load voltage.

CALL TOLL-FREE TO ORDER 800-833-8400
In New York call (716) 874-5510.

Mail orders accepted. VISA, Mastercard or checks.

GLADSTONE ELECTRONICS, INC.

1585 Kenmore Avenue Buffalo, New York 14217

In Canada: Gladstone Electronics, Toronto 800-268-3640

CIRCLE 71 ON FREE INFORMATION CARD

STATE OF SOLID STATE

Power transistor driver/amplifier

ROBERT F. SCOTT, SEMICONDUCTOR EDITOR

WHENEVER HI-FI EXPERIMENTERS OR audio engineers begin a high-power audio amplifier, they are immediately faced with the question of how to interface the op-amp or low-level discrete voltage-amplifier devices to the power amplifier. The 741 or a similar op-amp—operating from power supplies of ± 6 to ± 12 volts and delivering a maximum of around 5 mA—cannot drive power transistors and Darlington configured devices. In a 50-watt RMS amplifier operating from a ± 35 -volt supply, those devices require 50 mA or more of drive.

Most approaches to the problem have used two or more discrete driver stages—each with its own power-supply requirements, SOA (Safe Operating Area) protection, and short-circuit protection.

Intersil has taken another approach—they have developed a dedicated IC that is the total solution to the problem of driving almost all power transistors with breakdown voltages up to 70 volts. The device—the ICL8063—is a monolithic power-transistor driver and amplifier. It is intended primarily for complementary-symmetry outputs in an audio amplifier and as a driver for linear or rotary actuators, and servo and stepping motors. It is compatible with most op-amps and

dedicated devices such as preamps and companders; taking output levels in the order of ± 11 volts and boosting them to ± 30 volts at 100 mA to drive power transistors. For example, Intersil used 2N3055 (NPN) and 2N3791 (PNP) as the output transistors in their data-sheet circuits. The ICL8063 includes built-in ± 13 -volt regulated outputs to power op-amps or other external devices. Therefore, only ± 30 -volt supplies are needed for a complete power amplifier.

Using the ICL3068, we can build a power amplifier delivering ± 2 amps at ± 25 volts with only three additional discrete devices (a pre-driver and two power transistors) and as few as eight passive components. The slew rate of the power amplifier is the same as that of the 741 pre-driver by itself; except that the output current can slew up to 2 amps at $1\text{V}/\mu\text{s}$. Other factors such as common-mode rejection ratio (CMRR), input current, voltage offset and power-supply rejection ratio (PSRR) are also the same as for the 741 op-amp. Typically three 1000-pF ($.001\text{ }\mu\text{F}$) compensating capacitors are used to insure good stability down to unity gain. The circuit will drive a 1000-pF load (as might be represented by 30 feet of RG-58 coaxial cable) in line-drive and

plication, without problems. Quiescent current is only 30 mA from a ± 30 -volt power supply.

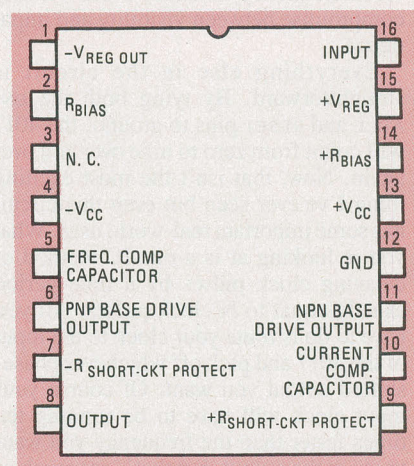


FIG. 2

A \$20-per-channel 50-watt amplifier

Figure 1 is the schematic of a power amplifier using the ICL8063 to drive 2N3055 and 2N3791 power transistors to 50 watts into an 8-ohm load. (The pinout of the ICL8063 is shown in Fig. 2.) The first 741 is a preamp for FM tuner and phonograph inputs. The phono input has RIAA (Recording Industry Association of America) equalization. The second 741 is a pre-driver for the ICL8063. The complementary-symmetry-output transistor stage delivers 56 volts P-P (50 watts RMS) into an 8-ohm speaker. Distortion is less than 0.1% up to about 100 Hz and increases to about 1% at 20 kHz.

The 0.4-ohm resistors limit the maximum output current that can be drawn. The 1-megohm biasing resistors (between pins 2 and 4 and 13 and 14) are based on $V_{CC} = \pm 30$ volts and guarantee adequate performance when driving DC motors, programmable power supplies, and power DAC's. You can decrease V_{CC} from ± 30 to ± 5 volts in 5-volt steps by using 1 megohm, 680K, 500K, 300K, 150K, and 62K biasing resistors.

When selecting the output transistors for the amplifier, make sure that their beta (hfe) does not exceed 150 at $I_C = 20 \text{ mA}$ and $V_{CE} = 30 \text{ mV}$. The output terminal can be shorted to ground for an indefinite period as long as the transistors have adequate heat sinks.

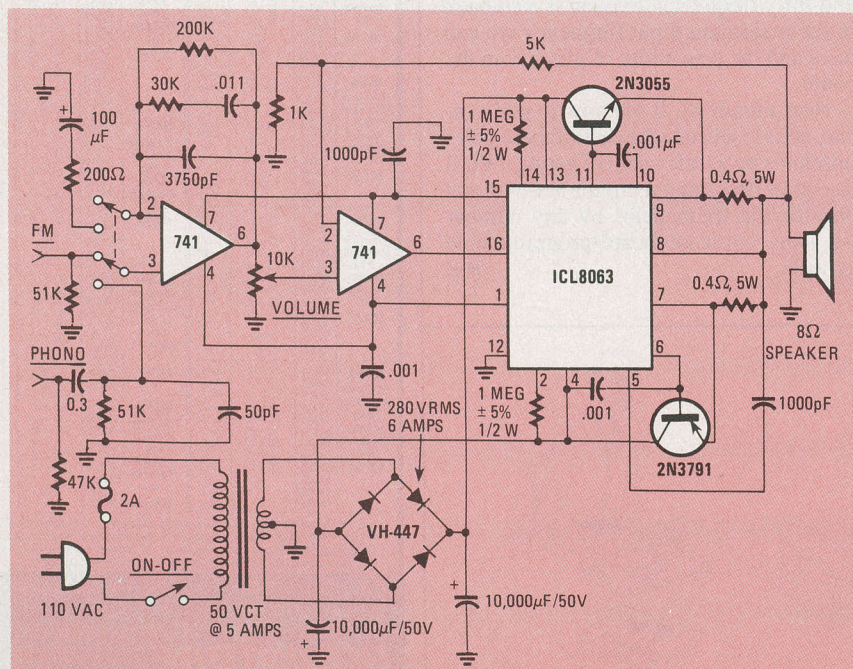


FIG. 1

CABLE TV

CONVERTERS DESCRAMBLERS

**Largest Selection
of Equipment Available**
\$ Buy Warehouse Direct & Save \$



36 channel
converter
\$45.95

36 channel
wired remote
converter
only
\$88.95



Send \$2 for complete catalog
of converters and unscramblers

Quantity Discounts • Visa • Master Charge
Add 5% shipping—Mich. residents add 4% sales tax

C&D Electronics, Inc.
P.O. Box 21, Jenison, MI 49428
(616) 669-2440

Dual high-speed rectifiers

The RUR-D1610, -D1615, -D1620 series is a new family of RCA ultra-high-speed dual-chip rectifiers intended as output rectifiers and fly-wheel diodes in high-frequency pulse-width-modulated power supplies and switching regulators. The devices feature a current-carrying capacity of 16 amps per diode and a recovery time of less than 35 ns. Maximum forward voltage drop (at 25°C and full rated current) is 0.95V.

The low stored-charge and fast recovery of the RUR series minimizes electrical noise and, in many circuits, reduces the turn-on power dissipation of associated switching transistors. Breakdown voltages for the RUR-D1610, -D1615, and -D1620 are 100, 150, and 200 volts, respectively. The devices are in steel TO-204M packages. RCA, Box 4200, Somerville, NJ 08876.

New Voltage regulators

Motorola has introduced a series of three-terminal negative-voltage regulators capable of supplying in excess of 1.5 amps over an output-voltage range adjustable from -1.2 to -37 volts. These voltage regulators—the LM137/237/337—are easy to use and require only two external resistors to set the desired output voltage. Added features found in the new series include internal current limiting, thermal shutdown, and safe-area compensation.

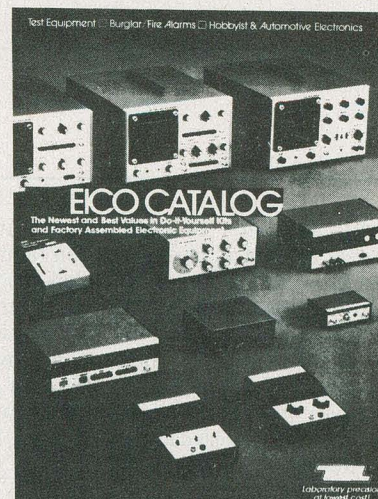
The LM337T, 337H, and 337K are packaged in TO-220, TO-39 and TO3 housings, respectively. Their temperature range is 0°C to +125°C. Prices range from \$1.35 to \$3.60 each in 100-999 lots. The LM237 and LM237K are in TO-39 and TO-3 packages, respectively and are developed to operate in the -25°C to +125°C range. The LM137H and LM137K operate over a -55°C to +150°C temperature range and are in TO-39 and TO-3 packages, respectively. Motorola Semiconductor Products, Inc., PO Box 20912, Phoenix, AZ 85036.

Memory design kit

The TMS4500-Kit from Texas Instruments is the firm's new *MOS Memory Design Kit* that comes with enough devices and supporting literature to permit you to design a 32K byte memory system. The kit contains four TMS4416's—the firm's newest DRAM (Dynamic Random Access Memory)—and the new TMS4500A DRAM controller featuring an address multiplexer, refresh counter, timing and control circuits, and logic for microprocessor access and memory-refresh sequences. The kit, available through authorized TI distributors, carries a suggested sale price of \$50.00. Texas Instruments, Semiconductor Group, PO Box 401560, Dallas, TX 75240.

R-E

The world of electronics gee-wizardry



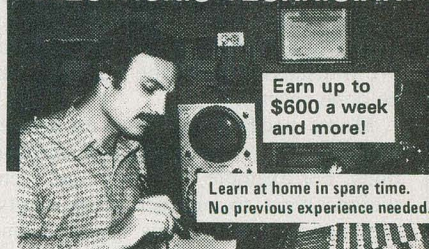
-YOURS FREE.

32-pages of test instruments—from the latest digital multimeters to the famous EICO scopes. Security systems. Automotive and hobbyist products. Kits and assembled. EICO quality. EICO value. For FREE catalog, check reader service card or send 50¢ for first class mail.

EICO 108 New South Road
Hicksville, N.Y. 11801

CIRCLE 58 ON FREE INFORMATION CARD

Be an FCC LICENSED ELECTRONIC TECHNICIAN!



Earn up to
\$600 a week
and more!

Learn at home in spare time.
No previous experience needed.

No costly School. No commuting to class. The Original Home-Study course that prepares you for the FCC Radiotelephone license exam in your spare time! An FCC Government license is your "ticket" to thousands of exciting jobs in Communications, Radio & TV, Mobile two-way, Microwave, Computers, Radar, Aerospace and more. You don't need a college degree to qualify, but you do need an FCC License. **No need to quit your job or go to school!** You learn how to pass the FCC License exam at home at your own pace with this easy-to-understand, proven course. It's easy, fast and low cost! **GUARANTEED PASS**—You get your FCC License or money refunded. Write for free details. Soon you could be on your way to being one of the highest workers in the electronics field. **Send for FREE facts now. MAIL COUPON TODAY!**

COMMAND PRODUCTIONS

FCC LICENSE TRAINING, Dept. 90
P.O. Box 2223, San Francisco, CA 94126
Rush FREE facts on how I can get my FCC License in spare time. No obligation. No salesman will call.

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

NOVEMBER 1983

107

MICRO-PROFESSOR

MPF-1 USER'S AND EXPERIMENTAL MANUAL

Dear Electronic Enthusiast:
Now... Let the Micro-Professor™ usher you into the microcomputer revolution.
The Micro-Professor™ is the first, really low-cost learning system designed for personal use. It will truly become your "Personal Computer".
Sincerely,
Chris Johnson
Chris Johnson, Customer Service

only **\$129.95**

Z-80 BASED

MICROCOMPUTER

A superb learning tool for students, instructors, hobbyists.

Nothing else needed. Just plug in and start learning! Complete experimenters manual, easy instructions, 18 experiments. Fully expandable for Z80-CTC, Z80-PIO, EPROM, Breadboarding and prototyping. Invest with confidence. Now only \$129.95, two for only \$239.95. 2KB BASIC interpreter now available, only \$19.00. Full money back guarantee!

Plus-FREE GIFT

Check this box for FREE Z-80 Microprocessor Programming and Interfacing textbook when you order within 7 days. \$12.95 value.



ETRONIX

Dept. RE-113
14803 N.E. 40th
Redmond, WA 98052

For immediate action call TOLL FREE:

1-800-426-1044

NAME _____
ADDRESS _____
CITY _____ ST _____ ZIP _____
☐ VISA ☐ MSTRCD ☐ EXP. _____
ACCT. NO. _____

CIRCLE 39 ON FREE INFORMATION CARD

COMPUTER CORNER

Computer graphics

LES SPINDLE*

THE GRAPHICS CAPABILITIES OF PERSONAL computers have long been familiar to game enthusiasts, who follow the exploits of their favorite arcade characters in vibrant, living color. And, as the use of computer graphics has become more widespread (take Disney's *Tron*, for example), more people have become aware of what computers can do in this area. But there are many important graphics applications besides entertainment. We'll examine some of them and then we'll review a few equipment-purchase considerations.

Charts and graphs

In a business environment, charts and graphs are the most popular media used to present information. That's because they can show complex data and trends in an easy-to-follow *visual* format. (Remember the saying: A picture's worth a thousand words.) That makes graphs and charts ideal for a group meeting. And it makes their production the most popular application for the graphics capabilities of business computers.

Often, especially with a small group of people, the computer's CRT screen can be used to view the graphics. However, for presenting information to a larger group, another method, namely producing hard (paper) copy, has to be used. We'll discuss some of the ways that can be done shortly.

Many professions use computer graphics for a wide variety of applications. For example, engineers and technicians want to produce flow charts, schematics, and various types of line drawings. With some highly sophisticated systems, images can be drawn in three dimensions, and an image—a bridge perhaps—can be rotated so that you can view it from various angles. That makes the graphics-capable computer ideal for architects and mechanical engineers.

What equipment must a hobbyist or small-business owner have in order to begin making reasonably efficient use of graphics? The terminal that is used is a very important part of the system. One graphics-capable terminal from Columbia Data Products is shown in Fig. 1. We discussed many terminal-buying con-



FIG. 1

siderations in a previous column, but a few words on the graphics capabilities of terminals would be appropriate here.

The "standard" business micro-computer or terminal has a monochrome, raster-scanned display that is satisfactory for many applications. However, multi-color capability is often more desirable. That's because if the color capabilities of a computer are used properly, the information contained in graphical form can be made clearer.

A screen format of 48 lines by 80 characters (alphanumeric; 484-by-512 pixels—picture elements—graphic) is adequate for most applications. In general, you want a terminal with a bit-mapped display. That means that each pixel is represented by at least one bit of memory. Allotting more bits per pixel increases the terminal's graphics capability because each pixel can take on various shades or colors instead of being limited to just being on or off. The maximum number of colors that can be displayed on the screen *simultaneously* is limited by the number of bits assigned per pixel. You can expect to pay anywhere from \$2000 up to \$15,000 for a business-quality graphics terminal.

Printers and plotters

If you need to have a printed copy of your screen graphics, you will want a graphics printer, or—for more specialized applications—a graphics plotter.

A graphics-capable impact dot-matrix printer is the least expensive way to obtain hard copy of graphic computer-output. Graphics printers can produce alphanumeric output as well as graphic output accompanied by alphanumerics. When producing graphics, the printer's

character generator is bypassed. Some printers can produce color output, although better color definition is usually achieved with the use of a plotter.

The principal reason for selecting a printer instead of a plotter is for speed. However, a problem with using a dot-matrix printer for graphics is that if a large area has to be filled in, the printhead can easily overheat. Other types of graphics printers (such as ink-jet printers) don't suffer from that problem.

A plotter will be required if you require detailed graphic output. Plotters can produce a variety of drawings, charts, diagrams and graphic copy—usually with better resolution than the impact graphics printer.

A *flatbed* plotter holds a flat sheet of paper in place, while a pen moves back-and-forth and up-and-down across the paper. The size of the drawing is restricted on this type of plotter. Only very large (sometimes cumbersome) units will accommodate large drawings.

The *drum* plotter advances the paper on a rotating cylinder. A pen is moved back and forth across the paper as the page rolls by. These plotters usually use a roll of paper, not individual pages. Therefore, the size of the output is limited in the horizontal direction, but not in the vertical direction.

An *electrostatic* plotter is limited to one color and requires a complicated programming method in order to generate the line-by-line point rasters. The paper is guided in one direction, and the impressions are made by a group of styli. Special paper must be used to convert the electrostatic charges into a series of dots. A character generator can be added, allowing the unit to perform double duty as a printer and a plotter. Very detailed work is possible with these units, and they are good at handling both graphics and text material.

You can expect to pay from \$800 up to about \$8000 for a good graphics-output device.

Software

Of course all of the hardware we have discussed is useless without some type of graphics-software package. Most software is designed specifically for only one type of system.

An important consideration in select-

*Managing Editor, *Interface Age* magazine

ing the graphics software is its ability to interface with other software that you may be using. For example, you would want your spreadsheet program to be compatible with your graphics program.

Among other useful features to look for as you shop are: the ability to scale charts up and down, label axes, and integrate text; curve-smoothing; moving averages; and the ability to spot trends through the use of regressions. There is a wide range of features to support various systems. Take the time to view thorough product demonstrations from your dealer when you are looking for the best package for your needs.

Among all computer products, graphics hardware and software provide the widest range of features from product to product. A rule that you should follow when shopping for any computer equipment holds true here also: Be sure to define your requirements carefully before you begin to shop. Making the right selection may take a little effort, but the benefits will be well worthwhile. **R-E**

NEW
VARIABLE RATE BONDS
MAKE IT
SMART TO **Take**
stock
in America.

SAVE!

MONEY • TIME • FREIGHT

**QUALITY STEREO EQUIPMENT
AT LOWEST PRICES.**

**YOUR REQUEST FOR QUOTA-
TION RETURNED SAME DAY.**

**FACTORY SEALED CARTONS—
GUARANTEED AND INSURED.**

SAVE ON NAME BRANDS LIKE:

PIONEER	JVC
KENWOOD	TEAC
MARANTZ	SANSUI
TECHNICS	SONY

**AND MORE THAN 50 OTHERS
BUY THE MODERN WAY
BY MAIL—FROM**

illinois audio

BANK CARDS ACCEPTED

12 East Delaware

Chicago, Illinois 60611

**312-664-0020
800-621-8042**

CIRCLE 94 ON FREE INFORMATION CARD



NEW
**Universal Keyboard
Controllers**
The new Series V Digital/Analog Keyboard Controllers from PAIA offer enough standard features and options to fill every need from stage to studio. Standard features include Pitch & Modulation Wheels, Gate and Re-trigger outputs, Low Note Rule Priority, Smooth Pratt-Read Action, Light weight and only 2" high.

You have your choice of:

- 37 or 61 Note Actions
- Exponential Or Linear C.V.
- MIDI or Parallel Digital
- Mono or Poly
- Factory Assm. or Low Cost Kits

Best of all, prices start at less than \$180

call our toll-free line

1-800-654-8657

9AM to 5PM CST MON-FRI

**for price & ordering details
& get your free PAIA catalog!**

Direct mail orders and inquiries to: Dept. 11R

PAIA Electronics, Inc.

1020 W. Wilshire, Oklahoma City, OK 73116 (405) 843-9626

CIRCLE 52 ON FREE INFORMATION CARD

**TECHNICIANS,
Get serious about
your profession;**



Now you can order the "Study Guide for the Associate—Level CET Test" from the International Society of Certified Electronics Technicians. It includes material covering the most often missed questions on the Associate CET Exam. 8½" x 11", paperback, 80 pages.

GET CERTIFIED!

Send check to ISCET, 2708 W. Berry St., Ft. Worth, TX 76109.

Name _____

Address _____

City _____

State _____ Zip _____

_____ copies @ \$5.00 ea.

Send material about ISCET and becoming certified.

NOW!

GET IBM-PC Capacity at a Fraction of IBM's Price!

New NETRONICS 16 Bit EXPLORER 88-PC Kit

Starts at Just \$399.95 - Accepts All IBM Peripherals.

It's true! Now you can enjoy the power of the Intel 8088—the same microprocessor which powers the IBM-PC—and run any program compiled for the IBM-PC...starting at only \$399.95!

Take this easy, low cost way to learn 16-bit technology! Two-board system features:

1. 8088 mother board with 5-slot expansion bus; accepts any hardware designed for IBM-PC; and
2. 64K memory board, expandable to 256K; with IBM compatible RS232 communications port.

Any disk-operating system which works on the IBM will work directly on the EXPLORER 88-PC, and all programs compiled for the IBM will run on it.

The system monitor ROM included in the Starter system features a user-friendly operating system that allows easy program generation and debugging. The commands include display/modify memory...display/modify registers...input/output data to I/O ports...block moves...single-step trace mode...go/run with optional breakpoint and register reports...cassette load/save with file labels...plus a complete system test program that tests and reports condition of ROM, RAM, cassette interface, timer, DMA controller, interrupt controller, and the communications port. These test programs not only allow easy debugging of software but they serve as hardware and software learning tools.

The EXPLORER 88-PC STARTER KIT includes a mother board, memory/I/O board, all components needed, sockets for IC's used, one 62-pin bus connector and complete assembly/test instructions. All you need is a soldering iron, solder, a power supply, and a standard RS232 terminal (Netronics has 2 low-cost ones to choose from).

Explorer 88-PC Starter Kit...\$399.95 + 10.00 p&i.

- ☐ (wired & tested, add \$100.00)
- ☐ Extra 62-pin connectors at \$4.25 ea. + 1.00 p&i.

Use your own terminal with the EXPLORER 88-PC or, if you plan to expand it to be fully IBM compatible, we offer our IBM compatible keyboard and an IBM compatible color graphics board (only available wired and tested).

- ☐ IBM compatible keyboard...\$299.95 + 10.00 p&i.
- ☐ IBM compatible color board...\$299.95 + 10.00 p&i.
- ☐ Additional ROM required...\$35.00.

Set your own pace! Invest and learn, at the rate YOU want! Add to your EXPLORER 88-PC:

Deluxe heavy-duty steel cabinet that houses either two 5¼" floppies or a 5¼" hard disk with one floppy. This cabinet features a brush-finish front panel and a wood-grained sleeve.

- ☐ EXPLORER 88-PC Cabinet...\$199.95 + 18.00 p&i.

A heavy-duty open frame power supply with fan that can be used in your own cabinet or installed into the Netronics cabinet is available as follows:

- ☐ 10 amp power supply for system + 2 floppies...\$149.95 + 8.00 p&i.
- ☐ As above + extra power for 1 hard disk...\$169.95 + 8.00 p&i.

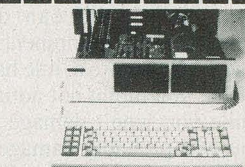
☐ IBM compatible disk controller board. Controls four 5¼" floppy drives (w/2 drive cable). Available wired and tested only...\$250.00 + 8.00 p&i.

☐ Monitors and BIOS source listings: available on either disk or hard copy at \$35.00.

Please specify format and system required.

☐ INTEL 8086/8088 user manual...\$15.00 + 1.50 p&i.

☐ THE 8086 BOOK by RECTOR & ALEX...\$16.00 + 1.50 p&i.



☐ Special IBM compatible system: with keyboard, color graphics board, floppy disk controller, 64K RAM, cabinet, standard power supply and a single 5¼" floppy drive...\$1899.95 + 25.00 p&i.

IBM compatible hard disks, built-in modern board, eeprom burner, print buffer system plus more will be available shortly.

Over 100 EXCLUSIVE Products and Kits—including the "Speak Easy" universal voice synthesizer, a Diagnostic card with built-in logic probe for the IBM-PC, terminals, monitors, the ELF and EXPLORER 85 computers, and much more, are described in our upcoming catalog. It's yours FREE if you check here ☐



"p&i" stands for "postage and insurance".

CALL TOLL FREE 1-800-243-7428 for Charge Card Orders.

In Conn., call 203-354-9375, Conn. res. add sales tax.

TO ORDER BY MAIL, CHECK BOXES FOR PRODUCTS DESIRED AND MAIL ENTIRE AD TO:



NETRONICS R&D LTD.

333 Litchfield Rd., New Milford, CT 06776

☐ Amount enclosed ☐ OR Charge my ☐ VISA ☐ MASTERCARD
Acct. No. _____ Exp. Date _____

Signature _____

PRINT NAME _____

Address _____ City _____ State _____ Zip _____

NOVEMBER 1983

SERVICE CLINIC

Full-wave bridge rectifiers

JACK DARR, SERVICE EDITOR

THE FULL-WAVE SOLID-STATE BRIDGE rectifier is certainly common. It's also a useful and simple circuit to understand. I say that, even though it took me about a year to learn how to draw one and get all the diodes going in the right direction! (Just to show you that I really do know how, I've included one in Fig. 1.) Many late-model TV sets use a full-wave bridge connected right across the AC line. That saves using a power transformer, *but* it has one disadvantage—for the technicians working on it. You **must** use an isolation transformer when servicing it. That's because, as shown in Fig. 1, the chassis is always at least 60 volts-AC above ground. I ran into such a set a long time ago. I plugged it in, touched the chassis and *Wham!* I said a few appropriate things and reversed the line plug but, of course, obtained the same result. I was doing things the hard way. It stung all the worse because I had an isolation transformer on the bench all the time! If you're not careful you can damage line-connected test equipment, such as your scope. (If you use a little battery-powered VOM, you might not notice it at all. But while you won't damage the meter, you will probably damage yourself.)

When compared to a half-wave type, the full-wave rectifier output has the advantage of being easier to filter. That's because there is less ripple—both halves of the cycle are used. Remember that; it can be a valuable clue. If you have filter problems that cause the familiar floating hum-bar on the raster, you'll see two bars instead of the usual one. That one is almost always caused by a low-value filter capacitor. Scope the ripple voltage to be sure.

There are peculiarities, of course. (Every circuit has 'em.) A shorted diode anywhere in the bridge will blow the fuse or trip the circuit breaker. That's easy to find with an ohmmeter. However, if one of the diodes should open, you'll get some odd reactions. Remember these—they've popped up lately in several sets. If a diode opens, the DC output voltage will not be affected very much—at least not enough drop to be a definite clue. However, the ripple voltage will always go up, and the ripple frequency will change. That can cause some problems in some sensitive circuits.

The ripple will not have two even peaks

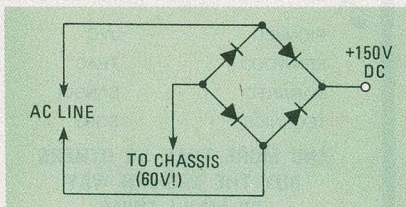


FIG. 1

(120 Hz) as it should. You may see one high peak and one low peak, or maybe only one peak at 60 Hz. Here's one example of a problem we ran into. In a fairly old set from General-Electric with separate diodes in the bridge, the sync was affected. That caused some sort of spike voltage that got into the sync circuits and made them false-trigger.

Another, and more baffling, case showed up in a Midland model 16-032. That little import job came in for lightning damage. One diode and a capacitor, plus the regulator transistor, were replaced; and it played—for a while. It developed an intermittent condition. Human-bar floated up the picture and a horizontal pull showed up in the middle of the raster. Turning it off and back on stopped that, and it worked for a short time. After some wheel-spinning, we scoped the ripple. When the fault showed up, the normal 120-Hz ripple disappeared, and a 60-Hz waveform came on. It was a bit higher than normal, but didn't look too big.

We were scoping through the 11-volt regulator. When the fault occurred, a definite 60-Hz spike showed up in the output! (If this circuit worked as it should, that shouldn't have gotten through the regulator.) We found that one diode in the bridge (separate) got warm when the fault appeared; that pointed to excessive current; the other diode in that leg was cold. Replacing the cold one cleared up the problem.

Some time back, I made a memorable goof; I said, positively: "Silicon diodes never open; they always short." Less than two weeks later that problem came in and I stood in my shop and looked at an open silicon diode! (I got a correction out as soon as possible). I would have said "Silicon diodes are never intermittent," but something told me to keep my mouth shut. Sure enough, the problem we just discussed was really the first time I'd run into a definitely intermittent silicon di-

ode, but I had a feeling all along that they were there somewhere. Moral: In this business, *never* say anything is impossible. If you do, it'll come back to haunt you.

This is a memo to fellows who write to the Clinic for help. *Please* guys; do *not* send mail to Boulder, Colorado! That's our subscription department; they have to send letters all the way back to New York before I can get 'em. That means that it takes a couple of weeks longer to get an answer back.

Here's one more, and more important memo. When you write in, remember to put your name and address in the letter! Even though that sounds silly, I've had quite a few letters in the last few months with no address at all. That's very frustrating—for some reason, those letters always ask questions that I know the answer to! If I can't find you I can't answer you.

Finally, here's a note for the "Help! Help!" department. If anyone out there has an 1LD5 octal tube, let Kelly Peters, Box 215, Alsen ND 58311 know about it. He needs one for an old Zenith he's restoring. *Don't* write me; tell *him* about it!

R-E

SERVICE QUESTIONS

DRIVE PROBLEMS

I read your column on horizontal sweep circuits and I'd like to argue a few points. In sets with the common problem of a hot horizontal-output transistor, check the amplitude *and* the waveform of the drive. If the drive is too *low*, the transistor will run hot!

In one case, the set had a good picture and good everything else, but the horizontal output transistor got very hot. I've found an open electrolytic bypass capacitor. The waveform was about half of drive.

In another case, a set had good picture and good sweep, but poor brightness regulation and the horizontal output transistor again ran hot. The cause of that was a resistor in the base of the horizontal-

output transistor that increased in value. Another symptom I saw was that the output transistor and the driver transistor both got hot. The waveform out of the oscillator was good, however. The cure was to add a 0.1 μ F capacitor across the 560-ohm resistor in the base of the driver. That makes it turn off and on completely, as it should—Eugene Spooner, Charlotte, NC.

ODDBALL CURE

I wrote to you about a TS915 Quasar with a strange problem. Blobs of different colors would creep up the screen three or four times a minute. You suggested checking the filter capacitors, etc. I did that, but it didn't help. After going around in circles a couple of days, I found out that the problem was with the degaussing coil. It was turned on all the time! The quick cure was to disconnect it.

Thanks to Leonard Pochop of Ontario, CA for that one. He used my favorite cure for degaussing-coil trouble!

COMPUTER-VIDEO PROBLEMS

In the May issue, there was a question from E.L.G. about a problem with a TRS-80 microcomputer with an intermittent video output. I had the same problem on my Model III. It turned out to be a poor contact on the CPU socket. It fooled me for a while because it seemed to be thermally sensitive. The cure is simply to clean all the pins and socket. A.K.?

I'd like to know who to thank for that, but I can't read his signature!

HANDY HINTS

I'm a technician who services G-E televisions. In the June "Clinic," a man wrote that he had a problem with cold solder joints in a 17AC 602. The SCR he mentioned, Q980 is a start-up SCR; when he put the jumper wire in he got a dark blob. The reason for that is that the SCR is now gated on! Take the jumper out.

It seems that a lot of people are having problems servicing the AB and AC chassis. What I did was to make up a chart of the connections that should be suspected. Following the chart, you can do some point-to-point wiring to find the problem. Be sure to use a low-wattage iron when soldering on those boards. If anyone wants information on how to get the chart, send me a note and a SASE—Douglas Stalker, Box 35A, East Chatham, NY 12060.

VERTICAL SWEEP PROBLEM

The raster is about 4-inches high in this RCA CTC-63XP. If I unhook the 47K resistor that goes to Q102, the horizontal-disable SCR, the raster comes back. Cooling the SCR brought the problem back again, as does cooling CR203, a zener di-

ode. I'm completely stumped, have you got any ideas?—D.V. Hollandale, MN

I'd try a new SCR and zener. Check for voltage across the zener to see if it's working normally. In this chassis, the connection from the disable circuit goes to the vertical circuit! Frankly, I don't know why. So, any problem here could upset the vertical sweep.

(Feedback: The new SCR brought in a jumping raster. I ordered a new hold-down control, R107, adjusted it, and that cleared up the problem entirely. I found that if R110 or R105 changes value, you will have the same problem. Dave Veldman, Hollandale, MN

CREEPING HIGH VOLTAGE

I've been using a trick for several years on CTC-51 -2-3-4-5 sets to cure a high-voltage creep. (It was discussed on page 99 in the July "Clinic.") I connect an 800-volt or 1-KV diode from the control grid to ground, with the cathode going to ground. With that, the grid cannot go more than 0.7 volts positive. It's saved a few tubes for me!—A.S., Willodale, Ontario.

Well, that should work. However, I still prefer replacement of the faulty tube; you may have to try two or three to find one, but it works. The control grid shouldn't go zero or positive, but even if it only "goes in a positive direction" it's enough to cause excessive current in the output tube. You pay your money, and you take your choice.

NO AC SWITCH?

When poking around into some AC/DC devices I've noted that many manufacturers leave the AC supply in an always-on condition when the unit is plugged in. When the unit is turned off, only the DC side of the supply is disconnected. Is that considered a safe practice? Of course the transformer/rectifier doesn't use much power, but couldn't it possibly cause trouble if the device is left plugged in with the switch off? Instructions never seem to include a caution to remove the AC plug.—M.W., Mt. Dora, FL

I think that the answer to that is a 5-letter word (cheap). When the DC is turned off, the set draws no measurable current. So it's cheaper to use an SPST than a DPST switch.

CONVERGENCE DRIFT PROBLEM

I worked on this Zenith 12A8C14 for quite a while on a problem of convergence drift. You told me to warm up the diode assembly. That did not help. I finally decided to take it out; I replaced it with three 300-volt 1-amp diodes. Presto! No convergence drift even after many hours. Thanks for pointing me in the right direction!

Thanks to Jerry McAulliff of Lincoln, Nebraska for that feedback. R-E

Versatile Lab Power Supply



EXCEPTIONAL
VALUE!

Only \$125⁰⁰

- 0-30 VDC at 0-2A • Excellent Regulation
- Ripple & Noise - 500 μ V • Built-in Short-Circuit and Overload Protection

Model 3002A features continuously adjustable current limiting and precision constant voltage/constant current operation with "automatic crossover." This lab-grade unit can also be used as a current regulated power source.

Optional 10-turn voltage & current controls: \$25 each. Add \$3.00 for UPS shipping in Continental U.S. Check, Money Order or C.O.D. accepted. Illinois residents add 6% sales tax.

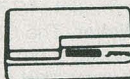


ELECTRO INDUSTRIES, INC.
4201 W. IRVING PK., CHICAGO, IL 60641
312/736-0999

CIRCLE 26 ON FREE INFORMATION CARD

CABLE TV Buy Direct & Save

SUPER SPECIALS



40 CHANNEL
CONVERTER
\$29⁹⁵

Advanced Solid State design and circuitry allows you to receive mid & super band channels. Restores programming to Video Recorders.



36 CHANNEL
REMOTE CONTROL
CABLE CONVERTER
\$69⁹⁵

JERROLD 400
THE ULTIMATE CABLE TV
CONVERTER



60 CHANNEL
INFRARED
REMOTE
CONTROL
\$129⁹⁵

Send \$5 for Complete Catalog

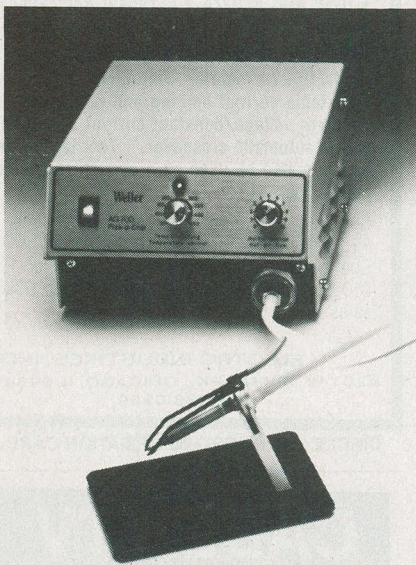
DIRECT VIDEO SALES
P.O. BOX 1329
JEFFERSONVILLE, INDIANA 47130
CALL
1-812-282-4766

CIRCLE 53 ON FREE INFORMATION CARD

NEW PRODUCTS

For more details use the free information card inside the back cover

HOT-AIR PENCIL, model AG700, has a built-in, electronically controlled air-supply pump and flow-heating system. It is designed for micro-electronic soldering and desoldering operations.



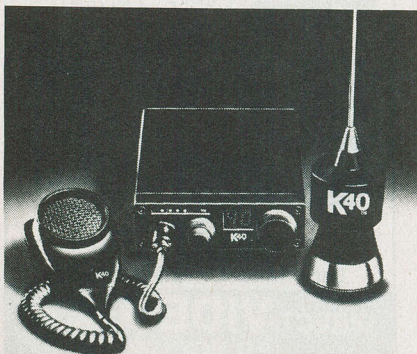
CIRCLE 111 ON FREE INFORMATION CARD

Measuring approximately 10 × 9 × 5 inches, the unit includes a 24-volt/50-watt output pen, adjustable from 50°C to 450°C, a 10-position air-capacity regulator, and a detachable chip tweezer. The model AG700 is priced at \$1,177.85. — **Weller**, The Cooper Group, PO Box 728, Apex, NC 27502.

CIRCLE 000 ON FREE INFORMATION CARD

CB RADIO SYSTEM, the K-40, consists of the K-40 speech processor microphone, the K-40 CB radio, and the K-40 magnetic-mount antenna.

The transceiver is 1¼ inches high, 4¼



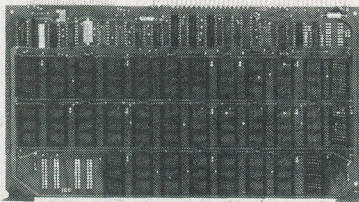
CIRCLE 112 ON FREE INFORMATION CARD

inches wide, and 6¾ inches deep, and will fit into many jacket or suitcoat pockets. It includes a frequency-synthesizer circuit, and heat-resistant transistors are used in all critical circuits.

The receiver is a dual-conversion superhetrodyne type with automatic noise limitation in the audio stages. The microphone has auto-sensitive amplifier circuits that adjust to voice levels from two inches to two feet away. There is also a tone-control switch to provide high-pitched transmissions during congested traffic conditions, or to switch down to a mellow tone. It can be clamped on to any metal surface; no microphone hook is needed.

The antenna is manufactured to tolerances that assures ±.0005" accuracy of coil spacings. The K40 CB Radio System is priced at \$199.00. — **American Antenna**, 1500 Executive Drive, Elgin, IL 60120.

EPROM BOARD, model M60155, can support up to 512 kilobytes of EPROM programming when fully loaded with 27128's. Alternatively, it can be loaded with 2764's or 2732's for a maximum storage of 256 kilobytes or 128 kilobytes, respectively. The board can decode a full 24-bit address, and be jumpered to decode only 20 bits, if so desired.

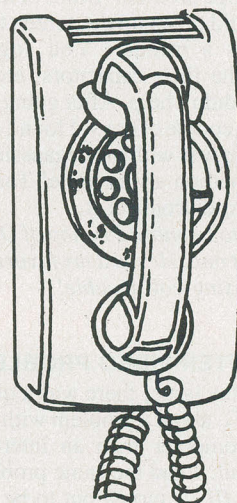


CIRCLE 113 ON FREE INFORMATION CARD

The memory can be accessed either as 16-bit words or 8-bit bytes with full Multibus byte swapping. The 2764's are supported on standard boards. The use of either 2732's or 2718's is a factory option.

The model M60155 is priced at \$525.00 — **TSD Display Products, Inc.**, 35 Orville Drive, Bohemia, NY 11716.

CORDLESS-TELEPHONE ANTENNA. The *Long Ranger Plus*, increases cordless-telephone range without the use of ground radials. Designed for do-it-yourself installation, no potentially warranty-voiding connections or modifications to the phone base station are required. The *Long Ranger Plus* is supplied complete with cable and all hardware necessary for mast mounting; or it may be mounted indoors with utility clips or

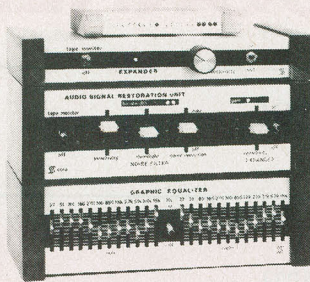


CALL NOW AND RESERVE YOUR SPACE

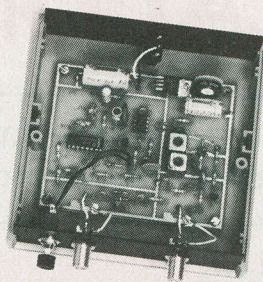
- 6 × rate \$550 per each insertion.
- Reaches 220,500 readers.
- Fast reader service cycle.
- Short lead time for the placement of ads.
- We typeset and layout the ad at no additional charge.

Call 212-777-6400 to reserve space. Ask for Arline Fishman. Limited number of pages available. Mail materials to: mini-ADS. RADIO-ELECTRONICS, 200 Park Ave. South, New York, NY 10003.

continued on page 117



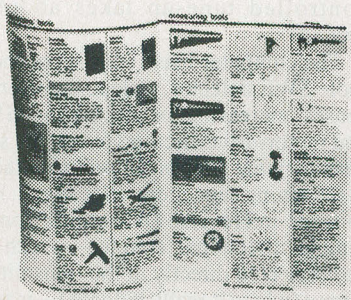
DIGITAL SOUND from your analog "Records and Tapes." By using dynamic expansion and filtering in sophisticated circuitry, the **ASRU** improves dynamic range by 18 dB. See **R-E's** 3-4/81 cover story or our free catalog (includes equalizers, power meters, etc.). **\$120** postpaid, M/C, Visa add shipping. **SYMMETRIC SOUND SYSTEMS, (707) 546-3895, 856H Lynn Rose Ct., Santa Rosa, CA 95404.**



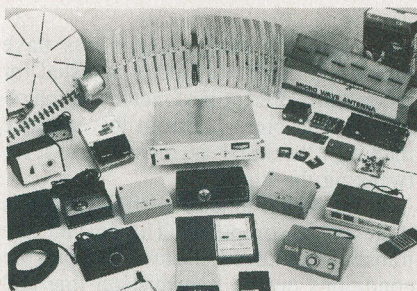
CABLE TV DESCRAMBLER KIT \$39.95 Computerized addressable gated sync type. We also have complete line of Jerrold and Oak cable TV converters and descramblers. Such as, Jerrold gated sync (SB-3), Oak sinewave (N12), and Jerrold 61 channel remote control converter descrambler (DRX-DIC-105). 90 day warranty. **SEND \$2.00** for "INFORMATIVE CATALOG" for prices and availability to: **J & W ELECTRONICS, INC., P.O. Box 61-X, Cumberland, RI 02864.**
CIRCLE 63 ON FREE INFORMATION CARD



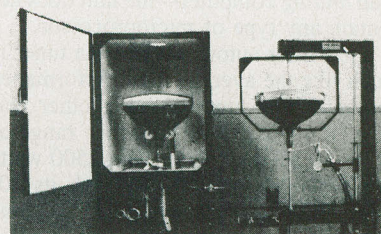
APPLIANCE REPAIR HANDBOOKS—13 volumes by service experts; easy-to-understand diagrams, illustrations. For major appliances (air conditioners, refrigerators, washers, dryers, microwaves, etc.), elec. housewares, personal-care appliances. Basics of solid state, setting up shop, test instruments. **\$2.65 to \$5.90 each.** Free brochure. **APPLIANCE SERVICE, PO Box 789, Lombard, IL 60148. 1-(312) 932-9550.**
CIRCLE 21 ON FREE INFORMATION CARD



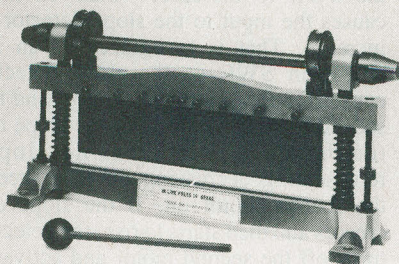
FREE CATALOG OF HARD-TO-FIND TOOLS is packed with more than 2000 quality items. Your single source for precision tools used by electronic technicians, engineers, instrument mechanics, schools, laboratories and government agencies. Also contains Jensen's line of more than 40 tool kits. Send for your free copy today! **JENSEN TOOLS INC., 7815 46th St., Phoenix, AZ 85040. (602) 968-6231.**
CIRCLE 57 ON FREE INFORMATION CARD



DESCRAMBLER SALE—JERROLD STAR BASE (SB-3) or OAK MINI-CODE (N-12) Ref. \$129 now \$79; Hamlin MLD-1200, reg \$159 now \$129; 63.5 Filters for bars and beeping, reg \$49.95 now \$29; Deluxe III UHF Sine-wave kit (the best) reg \$329 now \$175; Microwave system only \$59.95. Everything else 10% discount with this ad. **VISA-MASTERCARD and MONEY ORDERS ONLY!** Latest catalog \$5.00 (refundable) includes schematics. **TV PRODUCTS CO., 635 Park Ave., Idaho Falls, ID 83402.**



ONE MAN CRT FACTORY, easy operation. Process new or rebuild old CRT's for tv's, bus. machines, monitors, scopes, etc. Color, b/w, 20mm, foreign or domestic. 3x6 ft. space required. Profits??? Average CRT rebuilding cost — \$5. Sell for \$100 = \$95 profit; x 5 CRT's = \$475 daily; x 5 days = \$2375 weekly profit. Higher profits outside U.S.A. Investigate this opportunity today. We service the entire world. Write or call: **CRT Factory, 1909 Louise St., Crystal Lake, IL 60014, (815) 459-0666.**
CIRCLE 84 ON FREE INFORMATION CARD



Make your own prototypes! This 14" IN-Line Press Brake is constructed of high-grade ductile iron castings and steel parts. Standard equipment includes male dies for straight or box bends from 1/2" to 14" plus a FREE urethane forming pad. Write or call for literature and prices on our **SPECIAL Shear-Notcher-Brake** package. **PACIFIC ONE CORP., Suite K350, 513 Superior Ave., Newport Beach, CA. 92663; (714) 645-5962.**
CIRCLE 51 ON FREE INFORMATION CARD



MICROWAVE RECEIVER SALE—Complete system. Quality units similar to illustration. Made to sell for \$149.00. Our huge volume allowed special factory purchase. Made in U.S.A. Supply limited. Order today! (Dealer ten pack just \$499 FOB) **VISA, MASTERCARD or Money orders ONLY!** **T.V. PRODUCTS CO., 635 Park Ave., Idaho Falls, ID 83402.** **DESCRAMBLERS?** We stock all types. Send \$5.00 (refundable) for new catalog including schematics.



PAY T.V. DECODERS Completely assembled and tested. Compatible with ZENITH Z-TAC and SSAVI systems. No internal T.V. connections. Built in VARACTOR TUNER. **\$129.⁰⁰** **VISA, M/C, and C.O.D.** orders accepted. **DECODER DISTRIBUTORS CO., 23400 Michigan Avenue, Suite 502 Deaborn Michigan MI 48124 (313) 562 • 9661.** Other models available, we also ship to Canada
CIRCLE 92 ON FREE INFORMATION CARD

COMMUNICATIONS CORNER

A computer-controlled antenna tuner

HERB FRIEDMAN, COMMUNICATIONS EDITOR

BECAUSE OF THE SOMEWHAT EXTENSIVE, if not excessive, attention given microprocessors by newspapers, magazines, and even TV news programs, it's not uncommon to find that to many persons outside the computer industry the term computer is synonymous with microprocessor. Actually, the two don't necessarily have a relationship. We'll look at an example of that this month: an automatic antenna tuner, the J.W. Miller (19070 Reyes Avenue, PO Box 5825, Compton, CA 90224) model AT2500. While that tuner (shown in Fig. 1) uses a computer, it is an *analog* computer—the unit does not contain any type of microprocessor.

The Miller automatic antenna tuner is much like the average high-performance non-automatic tuner. Among other features, it's rated for a frequency range of 3.0 to 30 MHz at better than 2500 watts PEP for sideband; it will match its 50-ohm input to an output between 10 ohms and 300 ohms, and it will accommodate longwire and coaxially fed antennas. The tuner also has a built in output-power meter and a remote directional coupler for an SWR meter; and there are several protection devices—such as automatic drop-out of the linear amplifier or reduced output power through the transmitter's ALC (Automatic Level Control)—in case the SWR is excessively high.

Now all this sounds, or at least reads, familiar—just another feature-loaded antenna tuner. To some extent that is true. Both the loading coil (the “band selec-

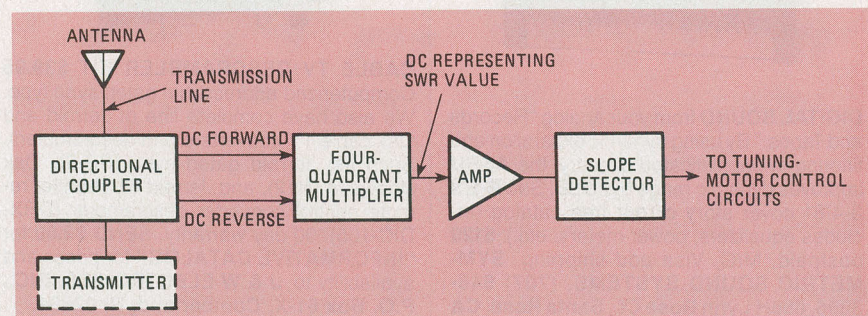


FIG. 2

tor”) and the tuning capacitors have knobs and can be manually adjusted for minimum SWR (or best match, whichever term you prefer). But in this instance manual “tuning” is mostly used for tweaking the tuner.

In the Miller tuner the “bull” work is done by a computer. The instant the transmitter is keyed, the tuner samples the conditions on the transmission line and feeds the information to a computer that controls small motors attached to the tuning capacitors. If the computer senses an SWR that exceeds a minimum value (selected by the user), the tuning motors automatically adjust the capacitors for continuously decreasing SWR. (The loading coil is pre-set by the user for a specific operating band or frequency range.) When the computer senses that the SWR is below the user-selected minimum SWR value it makes no further tuning adjustments. The average computer-

controlled tune-up takes about 15 seconds.

The computer itself consists of the remote SWR detector, a slope detector that senses increasing or decreasing SWR, and motor-drive circuits (fed by the slope detector) that control the motors attached to the tuning capacitors. (See Fig. 2.) The forward and reverse DC outputs from the remote directional coupler—which can be connected directly at the transmitter's output (where it really belongs)—is fed to a four-quadrant multiplier. There, the SWR is calculated from the two DC voltages sent by the remote coupler. The SWR value is represented by a DC voltage that is fed to an operational amplifier and on to a slope detector.

How it works

At the first instant of operation, one tuning motor steps. Assume that causes the SWR to increase, which, in turn, causes the input to the slope detector to increase. That is recognized as an increase in SWR so the slope detector causes the first motor to turn off and the second to start. As long as the slope detector senses a decreasing slope, representing decreasing SWR, it keeps the second motor on. If the slope decreases and then starts to rise, the detector turns off the second motor and activates the first. In other words, the detector alternately steps the tuning motors so that the slope tends to decrease.

At some point the motors must be stopped or they will constantly “hunt” for a lower SWR. That is accomplished through a front-panel TUNE SWR selector that is set by the user to the minimum acceptable SWR. Let's assume the selector is set for 2:1. When the SWR is reduced below the selected value—in this

continued on page 117

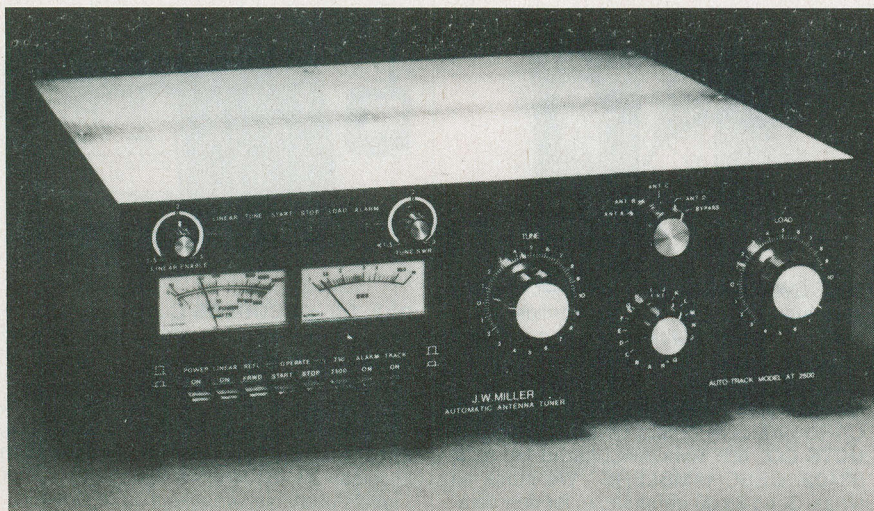


FIG. 1

Select 6 Books for Only \$2⁹⁵

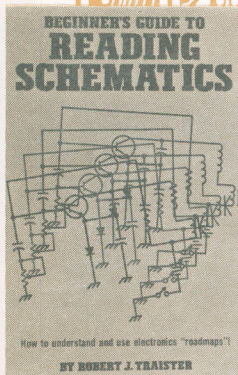
Save up to \$120⁷⁵ when you join



ELECTRONICS BOOK CLUB

The choice of hobbyists *and* professionals for over 18 years!

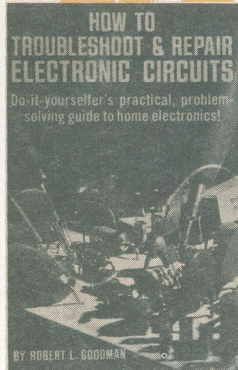
- Practical Troubleshooting & Repair Tips!
- Hundreds of Projects!
- State-of-the-Art Technologies!
- Exceptional Savings!



1536
List \$14.95



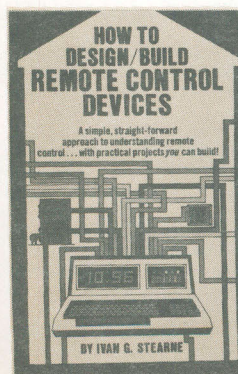
1451
List \$18.95



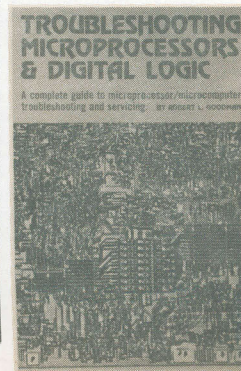
1218
List \$17.95



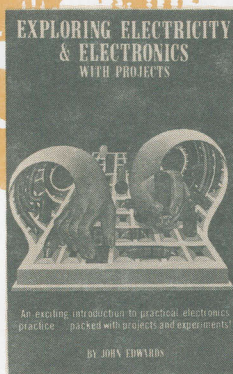
1409
List \$15.95



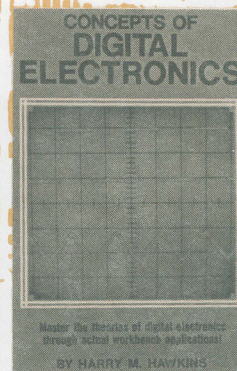
1277
List \$19.95



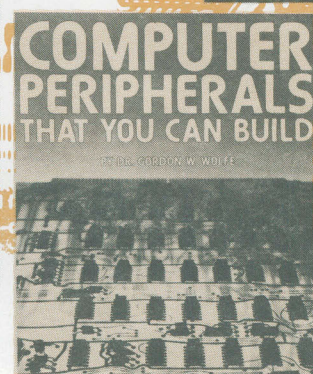
1183
List \$14.95



1497
List \$15.95



1531
List \$17.95



1449
List \$19.95



1529
List \$21.95

More books to choose from . . . see other side



ELECTRONICS BOOK CLUB

Blue Ridge Summit, PA 17214

Please accept my membership in Electronics Book Club and send the 6 volumes circled below, billing me \$2.95 plus shipping and handling charges. If not satisfied, I may return the books within ten days without obligation and have my membership cancelled. I agree to purchase 4 or more books at reduced Club prices (plus shipping/handling) during the next 12 months, and may resign any time thereafter. Order subject to acceptance by Electronics Book Club. **Valid for new members only.**

1050 1113 1128 1183 1218 1225 1271 1277 1296
1306 1337 1339 1346 1390 1393 1409 1427 1431 1449
1451 1465 1473 1486 1490 1497 1529 1531 1536

Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

(Orders for outside U.S. or Canada must be prepaid in International Money Orders in U.S. dollars. Canada must remit in U.S. dollars.) RE-1183

Build Your Electronics Skills . . . Join Now!

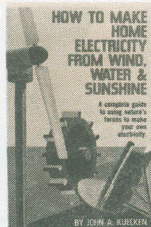
No other book source offers so much for such low cost!



1337
List \$9.95



1050
List \$13.95

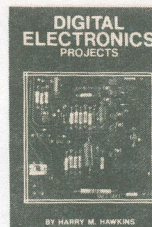


1128
List \$12.95

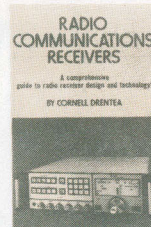
Take 6 Books for Only \$2.95

The Electronics Book Club puts you in the mainstream of today's electronics practice . . .

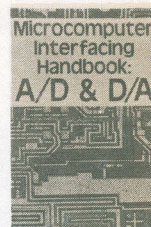
- Access to the latest state of the art developments in lasers, microcomputers, holography, robotics, test instrumentation, and more!
- Step-by-step how-to's for building your own electronic games, gadgets, home control devices, solar energy units, more!
- Expert guidance in every phase of electronics practice!
- Time- and money-saving tips on choosing, installing, maintaining all kinds of electronic equipment!
- Practical advice on how to turn your electronics knowledge into a profitable full- or part-time career!
- No other electronics information source offers you so much at such low cost . . . Save now, save every time you order the latest electronics and microcomputer titles from the Electronics Book Club!



1431
List \$17.95



1393
List \$19.95



1271
List \$18.95



1306
List \$19.95



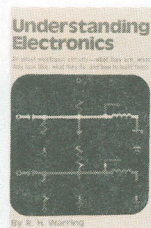
1296
List \$18.95



1490
List \$14.95



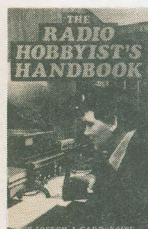
1473
List \$19.95



1113
List \$12.95



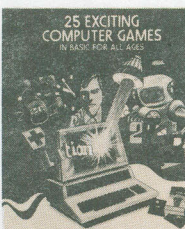
1486
List \$17.95



1346
List \$19.95



1390
List \$14.95



1427
List \$21.95



1225
List \$16.95

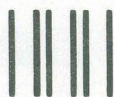


1339
List \$13.95



1465
List \$15.95

If card is missing, use this address to join:
Electronics Book Club, Blue Ridge Summit, PA 17214



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 9 BLUE RIDGE SUMMIT, PA 17214

POSTAGE WILL BE PAID BY ADDRESSEE

The Electronics Book Club

Blue Ridge Summit, PA 17214

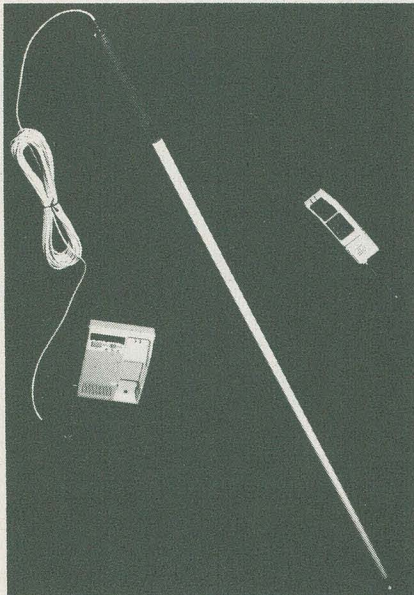
7 very good reasons to join Electronics Book Club Blue Ridge Summit, PA 17214

- **Reduced Member Prices.** Save 20% to 70% on books sure to increase your know-how
- **Satisfaction Guaranteed.** All books returnable within 10 days without obligation
- **Club News Bulletins.** All about current selections—mains, alternates, dozens—plus bonus offers. Comes 13 times a year with dozens of up-to-the-minute titles you can pick from
- **"Automatic Order."** Do nothing, and the Main selection will be shipped automatically! But . . . if you want an Alternate Selection—or no books at all—we'll follow the instructions you give on the reply form with every News Bulletin
- **Continuing Benefits.** Get a Dividend Certificate with every book purchased after fulfilling membership obligation, and qualify for discounts on many other volumes
- **Bonus Specials.** Take advantage of sales, special events, and added-value promotions
- **Exceptional Quality.** All books are first-rate publisher's editions, filled with useful, up-to-the-minute information

NEW PRODUCTS

continued from page 112

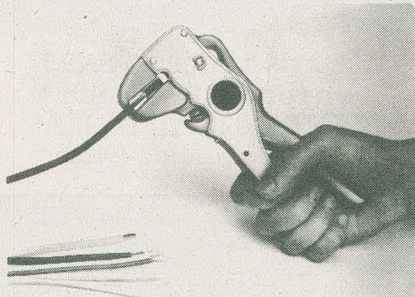
double-back tape (not supplied). It has been designed to meet the CPSC (Consumer Product Safety Commission) shock-hazard



CIRCLE 114 ON FREE INFORMATION CARD

standards to 14,500 volts. It is priced at \$59.95. — **Shakespeare Company**, RFD #3, PO Box 733, Newberry, SC 29108.

STRIPPING TOOL, model *PTS-3*, is a lightweight, multi-purpose hand tool that will strip wires of sizes between 10 AWG and 26 AWG and, in the case of multi-core cables, those with diameters up to 0.350 inch.



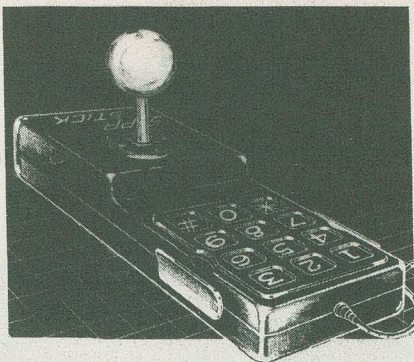
CIRCLE 115 ON FREE INFORMATION CARD

With a single squeeze of the handles, the insulation on the wire is severed and the slug automatically removed. The blades are self-adjusting and a tension-setting device is incorporated in the tool for extremely critical applications.

A wire cutter, for cutting wires to length, is incorporated in the tool, and all cutting and stripping blades are easily replaced. The tool is 7 1/4 ounces, and measures 6 3/4 x 3 inches; it is manufactured from a combination of hardened steel and polypropylene plastic.

The model *PTS-3* is priced at \$44.00. — **The Eraser Company, Inc.**, PO Box 4961/Oliva Drive, Syracuse, NY 13221.

JOYSTICKS, *Supr-Stick DeLux*, *Supr-Stick CC* (shown), and *Supr-Stik Xtra Lite*, all have



CIRCLE 116 ON FREE INFORMATION CARD

arcade components and microswitches. All components are replaceable, and the action button on each is located centrally to accommodate both left-handed and right-handed players.

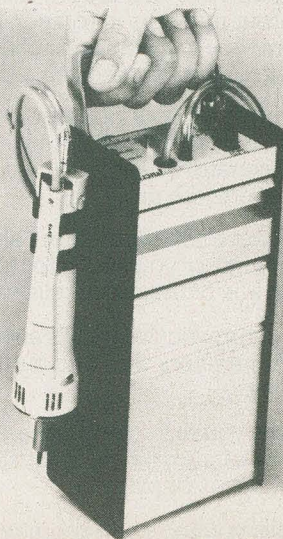
Supr-Stick DeLux includes suction feet and an automatic fire control; it is compatible with all Atari-type games and computers, and is priced at \$39.95.

Supr-Stick CC (Colecovision Controller) has the same quality full microswitch and features a full keypad with slot for overlays, and two oversize action buttons; it is priced at \$34.50.

Supr-Stick Xtra Lite uses smaller components and a smaller base; it does not include suction feet or auto-fire control, but as with the other two models, there is a one-year warranty. It is priced at \$19.95. — **D-Zyne Video Products, Inc.** 64 Dayton Road, Waterford, CT 06385.

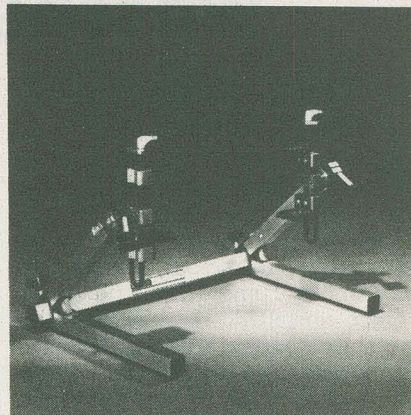
SOLDERING/DESOLDERING SYSTEM, model *MP-1*, is self-contained and so portable that it can be used anywhere that electronics equipment needs to be repaired — in depot, in mobile vans, in remote field-service centers, or on-site. It operates from AC and 12-volt DC sources.

The model *MP-1* warms up in one minute. Desoldering and soldering are accomplished with a single handpiece with a finger-activated vacuum. The model *MP-1* provides spike-free MOS safe operation and precise tip temperature control for high reliability repair. It is priced at \$395.00 — **Pace, Inc.**, 9893 Brewers Court, Laurel, MD 20707.



CIRCLE 117 ON FREE INFORMATION CARD

CHASSIS MOUNT, model 601 and model 602 (shown) offers a load capacity of a full 100 pounds and a width capacity of up to 18 inches. The upright arms, legs, and crossbars are made of 1/2-inch and 1 1/4-inch square tubing and provide a pivot-center height of 9 inches from work surface. For



CIRCLE 118 ON FREE INFORMATION CARD

safety, a positive lock detent is visible while rotating the chassis, and a visual indicator shows when the safety latch is engaged or disengaged. An all-metal friction brake allows for either left or right hand operation, and is located at a natural angle for a seated operator.

The model 601 has scissors clamp; the model 602 has self-centering heads; both are priced at \$199.95. — **PanaVise**, 14024 Sylvan St., Van Nuys, CA 91401. **R-E**

COMMUNICATIONS CORNER

continued from page 114

instance 2:1—a STOP command is issued by internal logic circuits and the motor-drive circuit is turned off. At that point the operator can manually tweak the controls if an even lower SWR is desired (assuming the SWR can be further reduced).

If the transmitter frequency is changed, causing the SWR to rise, the motor drive circuits will be reactivated when the SWR exceeds the TUNE SWR reference value.

Note that while there is no microprocessor of any kind, the tuner is truly computerized—it makes a decision based on the transmission-line variables (the input from the directional coupler) and the limiting variable (minimum acceptable SWR) specified by the user.

If you were to ask why the same idea or techniques could not be applied to tuning of the transmitter's final RF amplifier, the answer is, of course, that it is entirely possible. There is not much difference in sensing the slope of a DC voltage that represents SWR or the slope that represents input current to the final amplifier. Doing it for SWR is a little easier and a good starting point. With some refinement of the technique and a reduction in the cost of the components, automatic tuning will probably make its appearance in ham gear very soon. **R-E**

Your own telephone can become a 24-hour-a-day lifeguard!

The SENSAPHONE Transforms Your Telephone Into a Full-Time Monitor, Whether You're Home Or Not.

TALKS TO YOU — IN CLEAR ENGLISH

Your Sensaphone uses a standard built-in modular telephone connector. Instead of plugging your phone into the wall, plug it into the Sensaphone, then in turn plug the Sensaphone into the wall. Total time: 10 seconds.

Once installed, the Sensaphone does its job and reports its findings in clear English. For example —

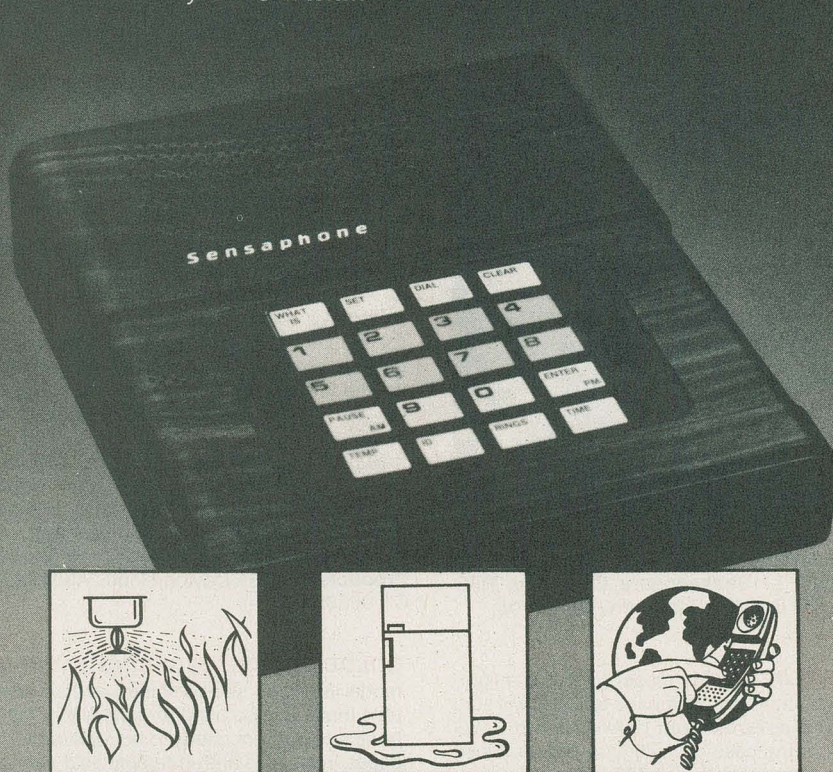
- If you aren't home and a problem occurs, it calls anyone you've designated and reports that problem, **in English**, then arranges to quit calling once the message is acknowledged.
- If you want to know what time it is, your Sensaphone tells you — **in English**.
- If you want to know the current temperature in the room, your Sensaphone tells you — **in English**.
- If the backup batteries (which hold the "memory" if you have a power failure) are low, your Sensaphone tells you so — **in English**.
- If you call in from the outside to learn how things are, your Sensaphone reports on all conditions — **in English**.

YOU MAY NOT BELIEVE IT AS YOU READ THIS, BUT YOU'LL BELIEVE WHEN YOU PLUG IT IN. YOUR MONEY BACK IF WE'RE EXAGGERATING.

Read This Section Carefully: Your SENSAPHONE Will Do All This —

1. You can call in from any phone in the world. SENSAPHONE will report every monitored condition to you.
2. You can listen to room sounds in your home or office through the powerful built-in microphone, from any phone in the world.
3. It reports **specific** unusual sounds, such as a smoke alarm's ringing or buzzing, or a burglar alarm.
4. It monitors and reports on any three other conditions of your choice (basement water level; door or window opening; water heater; appliance on).

MADE IN U.S.A. by Gulf & Western



Senses and reports problems in the home.

Calls for help so food won't spoil.

Monitor your home from any phone in the world.

5. (Get this!) If one of the pre-programmed problems occurs, it automatically calls you or anyone you designate, then states in English what the problem is. If the first person called doesn't answer, SENSAPHONE calls up to four numbers in rotation until someone answers and acknowledges receiving the call.
6. It monitors your household or office electricity, so if your refrigerator or lights go out, it reports the problem.
7. If room temperature rises above the number you preset, or falls below it, Sensaphone tells you so.
8. An automatic dialer calls any of eight numbers with one-button dialing.
9. It tells you the correct time, in English, including whether the time is a.m. or p.m.
10. It tells you the exact room temperature, on request.

The Sensaphone **\$249.95**
two for \$229.95 each
A FANTASTIC GIFT IDEA!

add \$3.50 per total order for shipping

WE ABSOLUTELY GUARANTEE!

Plug your home or office phone (or both) into the Sensaphone. Use it for up to 30 days. If for any reason you decide you don't want to keep it, return it for a 100% refund.

For fast delivery on credit card orders,
call toll-free 24 hours a day,
7 days a week:

1-800-443-0100

Ask for Extension 111

Or send check or money order.
Please add \$3.50 per total order
for shipping.

The **Sensaphone** is another electronic
marvel from

NEW HORIZONS

Dept. R11 • 5-31 Fiftieth Avenue
Long Island City, NY 11101

EQUIPMENT REPORTS

continued from page 42

sortment of half-watt resistors; two linear potentiometers; ceramic, electrolytic, and mylar capacitors; three inductors; an audio transformer; a variety of diodes and transistors; a 5741 operational amplifier, and a 555 timer. Also included are such miscellaneous items as solder, 22-gauge wire, a three-inch speaker, a 3579.545 kHz crystal, a small lamp, an alignment tool, and a small parts container.

As is usual with Heathkit educational products, the electronic circuits manual, which is packaged in a three ring binder, is clearly written, features informative, easy-to-understand graphics, and is printed on high-quality paper. Also included in the package is a series of six instructional records that are keyed to the text; they provide reinforcement and help speed the learning process.

It is important to realize that a good portion of the instruction involves hands-on circuit experimentation, which is very valuable. It greatly reinforces the material in the text, and helps assure that the material learned will be retained. But because there is so much experimentation certain test equipment, including an oscilloscope, a DMM, and the Heathkit *ET-3100B* trainer, are extremely helpful. The trainer, which is also used in the three previous courses in the sequence, is available as a stand-alone device for \$99.95 as a kit and \$169.95 fully assembled. It is also offered in a package with the course for \$144.95. The course alone sells for \$64.95.

What's covered

The first unit of the course concentrates on amplifier basics and explains the importance of those circuits. That module takes you through the basic types of amplifiers and their theory of operation. It completely discusses such topics as gain and biasing techniques. By the end of the chapter, you are designing basic common-emitter amplifiers and determining the class of operation for various amplifier circuits. Finally, you are led through amplifier-coupling techniques. The chapter also discusses such factors as thermal stability.

Unit two takes what you have learned in unit one and applies it to specific applications so that you gain a greater understanding of amplifier functions in different situations. It begins with circuits used to amplify DC and low-frequency AC signals and then progresses through a discussion of IF amplifiers, RF amplifiers, and video amplifiers. Also included are audio, and power amplifiers.

As you go through the unit, you learn about such things as a Darlington circuit and how a basic differential amplifier can be used to amplify a single input, as well

DON'T FORGET



USE
YOUR
READER
SERVICE
CARD

This publication is available in microform.



University Microfilms International

Please send additional information

Name _____
Institution _____
Street _____
City _____
State _____ Zip _____

300 North Zeeb Road
Dept. P.R.
Ann Arbor, Mi. 48106
U.S.A.

30-32 Mortimer Street
Dept. P.R.
London W1N 7RA
England

as why it offers a degree of temperature stability. You also learn the differences in amplifier types and about amplifier bandwidth. You also learn about the importance of neutralization and how a frequency multiplier works.

Unit three covers operational amplifiers. In it you will learn about common-mode rejection ratio, input resistance, output resistance, offset current, bias current, slew rate, and other factors that determine op-amp performance. The unit also will teach you about op-amp circuits such as comparators and simple inverting and noninverting amplifiers. Also covered are voltage followers, summing amplifiers, and differential amplifiers. The unit is rounded out with a discussion of lowpass, highpass, and bandpass active filters that use op-amps.

For many, the material presented in unit four will be old hat; that unit covers power supplies. That information is essential, however, to the beginner in electronics. In that unit the characteristics of half-wave, full-wave, and bridge rectifiers are discussed. You also learn about the effect of filter capacitors on output voltage, ripple voltage, and a diode's peak inverse voltage. After that, you'll find out about the characteristics of capacitor, resistor-capacitor, and inductor-capacitor filters, as well as the operation of half-wave and full-

MOVING?

Don't miss a single copy of **Radio-Electronics**. Give us:

Six weeks' notice

Your old address and zip code

Your new address and zip code

ATTACH
LABEL
HERE

name (please print)

address

city state zip code

Mail to: Radio-Electronics
SUBSCRIPTION DEPT., P.O. BOX 2520,
BOULDER, COLO. 80322

continued on page 124

MARKET CENTER

PLANS & KITS

CATALOG! 40 pages of neat electronics parts and kits. Send 50 cents refundable first order. **BEC ELECTRONICS**, Box 401244R, Garland, TX 75046.

FUN kits— low cost. Easy to build educational electronics projects. Handbook /catalog \$1.00. **TRI-ANGLE ELECTRONICS**, 89 Arkay Drive, Hauppauge, NY 11788.

PRINTED-circuit boards. Quick prototypes, production, design, reflow solder send print or description for quote to **KIT CIRCUITS**, Box 235 Clawson, MI 48017.

PROJECTION TV... Convert your TV to project 7 foot picture. Results comparable to \$2,500 projector... total cost less than \$30.00. Plans & lens \$19.95... Illustrated information free... Credit card orders 24 hours. (215) 736-3979. **MACROCOMA-GC**, Washington Crossing, PA 18977.

MOST advanced sine converter descrambler available. PCB and plans \$15. **JIM RHODES**, 1025 Ransome Ln., Kingsport, TN 37660.

CABLE TV converters and equipment. Plans and parts. Build or buy. For information send \$2.00. **C & D ELECTRONICS**, PO Box 21, Jenison, MI 49428.

SPIRIT life energy detector and separator complete plans \$4.00. **PO 893**, Torrance, CA 90508.

STOP

LOOKING FOR RESISTORS, CAPACITORS, DIODES, METERS, HARDWARE, CONTROLS, POWER RESISTORS, TRANSISTORS, IC'S, TRANSFORMERS, FUSES, KITS, LED'S, CABINETS. SEND \$1.00 (REFUNDABLE), FOR OUR CATALOG OF OVER 1200 ITEMS OR SEND A STAMP FOR OUR FLYER. 24 HOUR TURN AROUND TIME - LOW PRICES - 100% GUARANTEE

Daytapro Electronics, Inc.

3029 N. WILSHIRE LN., ARLINGTON HTS., ILL. 60004
312-870-0555

GIANT screen oscilloscope converted from any size TV. Technicians, hams, broadcasters, hobbyists: minor **inexpensive** changes convert TV to supersensitive testing device. No experience needed. Follow clear-cut plans. **Fully illustrated.** Perfect for workshop, lab, school, etc. **Any size screen ... any size TV complete plans ... \$4.00** (plus \$1.00 postage & handling). **MILLCO**, Dept OP-O3, Box 8561, Waco, TX 76714.

NEW AUDIO KITS

Stereo Synthesizer

Creates concert hall sound from any mono sound source. Get your hands on one of our "HOT" ones — Build anyone of our 26 satisfying premium hi-tech kits. Send for FREE CATALOG. **RODCAR ELECTRONIC SALES** 214-351-9895
9983 Monroe Drive Dallas, Texas 75220

UP-TO-DATE electronics kits. Amazing high quality. Unbelievable low price. Free catalog. **INTERNATIONAL POLYTECHNIQUES**, PO Box 862, New York, NY 10002.

HI-FI speaker kits, auto speakers systems and raw drivers from the world's finest manufacturers. For beginners or experts. Free literature. **A&S SPEAKERS**, Box 7462R, Denver, CO 80207 (303) 399-8609.

LIGHT chaser/color organ kits, rack mount units. 20% off sale. **DESIGN SPECIALTY**, PO Box 1995, Huntington Beach, CA 92647.

FREE KIT Catalog

FUNCTION GENERATOR KIT \$59.95
Auto-Ranging Cap-meter kit \$79.95

Phone 209-772-2076

Write or Phone for FREE CATALOG

DAGE SCIENTIFIC INSTRUMENTS
BOX 144 VALLEY SPRINGS CA 95252

contains
TEST &
EXPERI-
MENTER'S
EQUIP.

SAVE! Build your own cable TV converter. Complete manual \$3.00. **JKA ENTERPRISES**, Box 234, Lyman, SC 29365.

MICROWAVE television "downconverters". Exclusive new five stage design. Easily assembled. Catalog: \$2.00 (refundable). **NDS**, Box 12652-R, Dallas, TX 75225.

ULTRASONICS—complete kit builds attractive detector and solid state switch. Control AC lights, other appliances. Turns lights on when room is entered, off when room is empty. Use alone or as part of a security system. Complete kit \$49.50. Finished unit \$74.50. Mail check for prepaid immediate shipment. **ADVANCED ENERGY TECHNOLOGIES, INC.**, 30 Brower Ave., Okas, PA 19456.

VIC-20 owners. Build inexpensive 'X', 'Y' table. .0005" accuracy. Complete plans and cassette program \$9.95. **D&B ENGINEERING**, Box 5174 Spokane, WA 99205-0174.

MICROWAVE television "antenna." Highest possible gain. Definitely upgrades all existing microwave systems. Plans \$9.95. Kit \$34.95. **MICROWAVE SPECIALTIES**, Box 641, Citrus Heights, CA 95610.

LASERS: complete units \$150.00. Ruby rods from \$25.00. Laser surplus parts. Best prices anywhere. **MEREDITH INSTRUMENT**, 6517 W. Evia, Glendale, AZ 35302.

3½ digit led panel meter \$25.00. Make your own DVM capacitance meter. 6 month guarantee. For free brochure write to **DIGITAL DEVICES**, PO Box 511, Richmond, CA 94806.

To run your own classified ad, put one word on each of the lines below and send this form along with your check for \$1.90 per word (minimum 15 words) to:

Radio-Electronics, 200 Park Avenue South, N.Y., N.Y. 10003

ORDER FORM

PLEASE INDICATE in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of \$15.00.

() Plans/Kits () Business Opportunities () For Sale
() Education/Instruction () Wanted () Satellite Television

Special Category: \$15.00

PLEASE PRINT EACH WORD SEPARATELY, IN BLOCK LETTERS.)

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

PLEASE INCLUDE FOR OUR FILES YOUR PERMANENT ADDRESS AND PHONE NUMBER.

CLASSIFIED COMMERCIAL RATE for firms or individuals offering commercial products or services). **\$1.90 per word prepaid (no charge for zip code)...MINIMUM 15 WORDS.** 5% discount for 6 issues, 10% for 12 issues within one year, if prepaid.

NON-COMMERCIAL RATE (for individuals who want to buy or sell a personal item) \$1.25 per word prepaid...no minimum.

ONLY FIRST WORD AND NAME set in bold caps. Additional bold face (not available as all caps) at 15¢ per word. All copy subject to publisher's approval. **ADVERTISEMENTS USING P.O. BOX ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SUPPLIES PUBLISHER WITH PERMANENT ADDRESS AND PHONE NUMBER.** Copy to be in our hands on the 20th of the third month preceding the date of the issue (i.e., August issue closes May 20th). When normal closing date falls on Saturday, Sunday, or a holiday, issue closes on preceding working day.

DESCRAMBLERS

AMERICAN—CANADIAN

C-1000 / ZENITH TYPE

Descrambles "over the air" and "cable" sync suppressed active video inversion signals.

Ready to go C-1000 379.95
Complete Kit C-1000K 274.95
Printed Circuit & Manual 74.95

C-100 / JERROLD TYPE

Cable Descrambler for in-band gated suppressed systems.

Ready to go C-100 119.95
Complete Kit C-100K 54.95

SEND \$2 FOR COMPLETE INFORMATIVE CATALOG TO DETERMINE WHAT TYPE YOU NEED.

FALL SPECIAL
Buy 1 kit
Get 2nd kit
at ½ price

Offer ends 10/1/83

J & D ENGINEERING
P.O. Box 6099
Falmouth, Maine 04105

Dealers Wanted
Special Quantity Pricing
COD's—OK

All J & D products are engineered, not copied, all are guaranteed 90 days & we stand behind our products where others fail to

PLANS & KITS

CB MODIFICATIONS

Increase channels, range, privacy! We specialize in frequency expanders, speech processors, FM converters, PLL & slider tricks, how-to books, plans, kits. Expert mail-in repairs & conversions. 16-page catalog \$2.

**CBC INTERNATIONAL, P.O. BOX 31500RE,
PHOENIX, AZ 85046 (602) 996-8700**

COPY video game cartridges, worth \$200.00 for only \$2.00. Easy. Uses cassette tapes. Plans \$10.00. Information 75 cents. **HCO.**, Box 455, Sandy, UT 84091.

REPLACE NE 564 (UHF sine wave boards) deluxe I, II rev.B by IC. and parts available everywhere. Guarantee works great, modification, plans, circuit, chokes, \$25.00. Money orders only. **ADVANCE ELECTRONICS**, Box 3298, Culver City, CA 90230.

SCHEMATICS, Coleco, Intellivision, Timex 1000. \$9.95 each. **IRATA**, Box-RE, 2562 East Glade Mesa, AZ 85204.

HOW to save energy, AC., induction motor, one chip IC and few parts, no powersupply, work on AC. Saw, grinder, drillpress, etc. For circuit application note, send \$2.00. **JAYSHREE**, 8313 N.W. 109th Tr., OKC, OK 73132.

CATALOG: Hobby, CB, Broadcasting, Linears, transmitters, bugging devices, scramblers, down-converters, much more. \$1.00 (refundable). **PAN-AXIS**, Box 130-F11, Paradise, CA 95969.



TECHNI-TOOL inc.

TOOLS—TOOL KITS

FREE CATALOG

CALL (215) 825-4990

EXPERIENCE • QUALITY • VARIETY



BUSINESS OPPORTUNITIES

PROJECTION TV... Make \$\$\$ assembling projectors... Easy... Results comparable to \$2500.00 projectors... Your total cost less than \$20.00. ... **Plans, lens & dealers information** \$17.50. ... Illustrated information **free** ... **MACROCOM-GCX**, Washington Crossing, PA 18977. Credit card orders 24 hours. (215) 736-2880.

WHOLESALE MATV/CATV/VCR equipment, antennas, audio cables, adapters, original/replacement cartridges & styli, telephone accessories, radios, cassette recorders, speakers, etc., send letterhead for free catalog (212) 897-0509 **D&WR**, 66-19 Booth, Flushing, NY 11374.

MECHANICALLY inclined individuals desiring ownership of small electronics manufacturing business—without investment. Write: **BUSINESSES**, 92-R, Brighton 11th, Brooklyn, NY 11235.

VIDEO game repair business. Start your own. Information/parts list \$5.00. **BEST ELECTRONICS**, 4440 Sheena, Phoenix, AZ 85032.

EARN money! Selling computer software from your home. For details write to: **COMPUTER SERVICES**, PO Box 7748, Tucson, AZ 85725

HIGHLY PROFITABLE

ONE-MAN ELECTRONIC FACTORY

Investment unnecessary, knowledge not required, sales handled by professionals. Ideal home business. Write today for facts!

Postcard will do, Barta-RE-X, Box 248, Walnut Creek, CA 94597.

DESCRAMBLER SALE

JERROLD Star Base (SB-3) or Oak Mini-Code (N-12) reg. \$129.00 now \$79.00; **Hamlin MLD-1200**, reg. \$159.00 now \$129.00; 63.5 filters for bars and beeping, reg. \$49.95 now \$29.00; **Deluxe III UHF sinewave kit (the best)** reg. \$329.00 now \$175.00; **microwave system only** \$59.95. Everything else 10% discount with this ad. **Visa-MasterCard** and **money orders only!** Latest catalog \$5.00 (refundable) includes schematics. **TV PRODUCTS CO.**, 635 Park Ave., Idaho Falls, ID 83402.

Worlds Most Remarkable Radar Jammer!



Causes speed radar guns and devices to read out your choice of either a percentage of your true speed when in automatic mode (example: Your speed, 76 mph, auto mode set for 75%, speed displayed — 57 mph), or the speed that you dial in when in manual mode. Transmits only in the presence of speed radar, or by manual override. Operates on both X and K bands. **WARNING:** The device described in this literature is not legal for use against police radar, and is not FCC approved.

For complete literature and plan package, send \$14.95 to:

Philips Instrument Design Co. Inc.
8135 S.W. Nimbus, Building #11, Suite #114 S
Beaverton, Oregon 97005

PAY TV/AMATEUR TV RECEIVERS

24 hour movies, specials, sports, etc.
GUARANTEED FINEST models anywhere!!
Write or Call for FREE BROCHURE!

JARIK, 632 West Doran, Suite 602
Glendale, CA 91203, (213) 956-5839

SATELLITE TELEVISION

SATELLITE TV receiver breakthrough! Build your own commercial quality receiver now! Complete instruction manual \$10.00! **XANDI**, Box 25647, Dept. 21R, Tempe, AZ 85282.

FREE! information on 100 satellite television channels plus free catalog of proven do-it-yourself plans/kits for easy, low-cost, attractive satellite antennas. Wholesale electronics components. **GFI-5**, Box 9108, Missoula, Montana 59807. "Consumer Guide to Satellite Television"—\$6.95.

THE original **Howard/Coleman** TVRO receiver! Instructions, schematics, layouts, printed-circuit boards: **Robert Coleman**, Rt. 3, Box 58-ARE, Travelers Rest, SC 29690.

RECEIVE 80 channels satellite system only \$1299 complete information and order forms, send \$3.00 to **REMINGTON'S SATELLITE SALES**, RR2, Box 124, Noblesville, IN 46060.

SATELLITE cables, connectors type-N UG-21D/U \$3.00, elbow UG-57B/U \$5.25, UG-29B/U \$3.90, F-59A 10/2.15, RG-6/U 12 cents/ft, RG-59/U copper 12 cents/ft, RG-213/U 36 cents/ft, RG-214/U \$1.55/ft. Shipping 10%, \$3.00 minimum. Free catalog—**NEMAL ELECTRONICS**, 12240 N.E. 14th Avenue, N. Miami, FL 33161 (305) 893-3924.



SATELLITE TV MAGAZINE

A monthly of 100-plus pages.

Product Information — Test Reports
Antenna Installation — Legal Aspects

Satellite Television —
the growth industry of the '80's.

Send \$1.00 for sample copy to

SATELLITE TV MAGAZINE

P.O. Box 2384 - Dept. R — Shelby, NC 28150

CONVERT S/W KIT TO CABLE

CABLE sinewave descrambler from over-air. Instructions including deluxe, scrambled microwave, optional over-air, \$8.00. Manual in descrambler troubles classification, instructions, \$20.00. **SIGNAL**, Box 2512-R, Culver City, CA 90230.

CABLE-TV EQUIPMENT

DESCRAMBLERS for cable TV model TX-200, amazing price, only \$79.95 compatible with Jerrold Starbase-3 or any gated pulse system. Automatic gain control. Highest quality components. One year guarantee. Other types available. Deluxe catalog \$3.00. **TELETECH**, 120 Wall Street, Suite 1044, Dept. RE 11, New York 10005.

TI-99/4A SOFTWARE

TI-99/4A owners. Send for free list of new and exciting, low cost software. **DYNA**, Box 124, Hicksville, NY 11801.

TIMEX/SINCLAIR

ONLY Timextown has **Compucat II**. You load this 16K catalog into your T/S computer— it's not on paper. Tape has free sample programs too! Just \$4.00 ppd from: **TIMEXTOWN**, POB 318R, Nfld, NJ 07435.

EPROM PROGRAMMING SERVICE

EPROM programming service for hobbyists and commercial users. All common EPROM types. Write for complete listing and price information. **ELECTRONIC COMMUNICATIONS SERVICES**, PO Box 441, Franklin Park, IL 60131.

FREE LCD WATCH WITH KIT

LSR UHF converters with AGC: gated pulse wave BT-1 (speaker box), parts \$115.00. Sound out from the TV type: deluxe IIB sine wave, parts \$100.00; digital Z/FV-5, parts \$175.00. Quantity discounts. Plans: large SASE (54 cents postage). Free shipping/handling. 1-312/267-3455. **LSR ENGINEERING**, Dept. RE, Box 6075, Chicago, IL 60680-6075.

SINCLAIR/TIMEX

COMPUTER aided design now available to the experimenter at low cost with our **EE** series software. **EEPWR** designs fully regulated solid state DC power supplies to your specs. **EESPK** designs custom speaker enclosures and crossover networks. Each performs all calculations, displays circuit diagrams. 16K cassettes \$24.95 each. Both \$39.95. Details \$1.00. **MINDGATE**, Box 74, Kenmore, NY 14217.

REEL TO REEL TAPES

TRUCKLOAD sale Ampex high quality open reel tape, 1800' or 2400' on 7" reels, used once. Case of 40, \$45.00. Cassettes available. **VALTECH ELECTRONICS**, Box 6-RE, Richboro, PA 18954.

CABLE TV

CHANNEL 3- 65 dB super notch filter. 63.5 mHz. \$29.00 postpaid. **TV PRODUCTS**, 635 Park Ave., Idaho Falls, ID 83402.

DEALERS wanted: Channel 3 notch filters, send \$15 for sample and quantity price list. **Money back guarantee.** **LEE KURTZ**, 235 SW 87th Ter., Plantation, FL 33324.

CB EQUIPMENT

CB radio books, kits, modifications, catalog \$1.00 refundable. **APS**, PO 263RE, Newport, RI 02840.

WANTED

WANTED: old Western Electric, RCA, tubes, speakers, amplifiers. 713 7284343. **MAURY CORB**, 11122 Atwell, Houston, TX 77096.

INVENTIONS, ideas, new products wanted for presentation to industry and exhibition at national technology exposition. Call 1-800-528-6050. Arizona 1-800-352-0458. X831.

ROBOTICS BOOKS

ROBOTICS books— build your own robot. Write now for free catalog. **KOHN** RE11, Box 16265, Alexandria, VA 22302.

DESCRAMBLER TROUBLES

SINE wave descrambler problems? Manual includes trouble shooting, alignment, antenna hook-up, improvements, theory. \$15.00. **SIGNAL**, Box 2512-R, Culver City, CA 90230.

FOR SALE

CABLE TV products: Wireless, corded & settop converters. Send \$3.00 for catalog. **ADDITIONAL OUTLET CORP.**, 231 E. Commercial Blvd., Ft. Lauderdale, FL 33334.

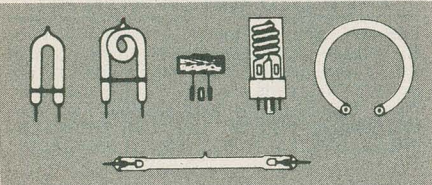
CABLE TV SECRETS—the outlaw publication the cable companies tried to ban. HBO, Movie Channel, Showtime, descramblers, converters, etc. Suppliers list included. Send \$8.95 to **CABLE FACTS**, Box 711-R Pataskala, OH 43062.

RESISTORS ¼ & ½W5% C.F. 3 cents. 1% M.F. All values. **No minimums.** Volume discounts. Write **JR INDUSTRIES**, 5834-B Swancreek, Toledo, OH 43614.

COLOR computer VIC-20 programs hardware Ritty code EPROM Programmer RS-232 **FRANK LYMAN**, Box 3091, Nashua, NH 03061.

PRINTED-circuit boards: single side, prototype, and quantity, quick delivery. Send positive, free quotes. **FABTRON**, Box 925, Dept. C, Columbia, TN 38401 (615) 381-1143.

XENON FLASH LAMPS



**ASK FOR OUR NEW CATALOG.
CALL OR WRITE FOR INFORMATION.**

TEC/WEST (USA) INC.
10889 WILSHIRE BLVD., SUITE 740
LOS ANGELES, CA 90024-4299
CA: 213/208-5529 • OUTSIDE CA: 1-800-421-7215

RADIO West — still the best for SW/MW DX receivers and receiver modifications! Catalog 50 cents. **RADIO WEST**, 3417 Purer Road, Dept RE, Escondido, CA 92025 (619) 741-2891.

SCANNER/monitor accessories—kits and factory assembled. Free catalog. **CAPRI ELECTRONICS**, Route 1R, Canon, GA 30520.

RECORDS—tapes! Discounts to 73%; all labels; no purchase obligations; newsletter; discount dividend certificates; 100% guarantees. Free details. **DISCOUNT MUSIC CLUB**, 650 Main Street, PO Box 2000, Dept. 3-1183, New Rochelle, NY 10801.

SATELLITE, microwave, video, audio components and equipment. Send \$1.00 for 1983 catalog. **DSCo**, Department F, 3110 Evelyn Street, Roseville, MN 55113.

TI-99/4A software. Free price list plus newsletter. **GLEN DOBBS**, Box 801 RE, Santa Maria, CA 93456.

NEW! MULTI-CHANNEL MICROWAVE

Complete Antenna Systems from \$69⁹⁵

Full 800 Mhz Range
Tune 1.9-2.7 Ghz
Includes all
ITFS Channels

DEALERS WANTED

COD's and Credit Card
Orders call TOLL FREE

1-800-247-1151

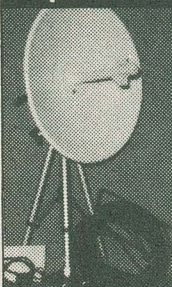


GALAXY ELECTRONICS
6009 N. 61 Avenue
Glendale, AZ 85301
1-602-247-1151



QUALITY MICROWAVE TV ANTENNAS

1.9 to 2.6 GHz
Frequency Range
Complete System (Pictured)



20" Parabolic Dish.
Pre-Assembled Probe with Down
Converter, Power Supply and
Tuner Switch. 63' of RG 59/U
Coax with Connector. Trans-
former for 75 to 300 Ohms. All
Mounting Hardware for Fast and
Easy Installation

S&W ELECTRONICS

145 North Main
Bountiful, UT 84010

(801) 295-1166

Dealers Wanted - COD'S

Suggested Retail \$259.00

Special \$74.95

2 Year Warranty



ELECTRONIC Surveillance! Incredible manual, "Homebrew Bugging" outlines wiretapping, bugging, and other techniques used by professional operatives (schematics included)—\$15.00. Send \$3.00 for our catalog of amazing books and products. **A.T.I.S.**, Dept. R, 61 Gatchell St., Buffalo, NY 14212.

ALARM! Vic 20/ 64 CoCo Sinclair become \$1000 burglar fire system. Cassette, documentation (specify microprocessor) \$29.00. Retailers inquire. Catalog. **SKIDMORE'S H.N'S**, 716 Walker Avenue, Greensboro, NC 27403. Sinclair piano, music program, cassette all hardware \$9.00.

DESCRAMBLERS for downconverters, high gain. Free information. **RB ELECTRONICS**, PO Box 643, Kalamazoo, MI 49005.

PRINTED-circuit boards: Your artwork, quick delivery, reasonable. Quantity discounts. **ATLAS CIRCUITS**, Dept. A, Box 892, Lincolnton, NC 28092 (704) 735-3943.

UNUSUAL UHF decoder kits and other units. Visa, MasterCard. **TROJAN ENTERPRISES**, 2920 Shelby, Indianapolis, IN 46203.

Govt. SURPLUS ELECTRONIC EQUIPMENT CATALOG

New ITEMS... New BARGAINS!
FREE UPON REQUEST!

Send today for FREE copy of
NEW CATALOG 83 • Address: Dept. RE

FAIR RADIO SALES

1016 E. EUREKA • Box 1105 • LIMA, OHIO • 45802

ADVENT and Kloss video parts and service available from **PROFESSIONAL ELECTRONICS**. Call 504-467-1717 for further information.

PRINTED-circuit boards: quotes free. **SASE** to **JAHMAAL ELECTRONIC SUPPORT**, PO Box 397, Troy, NY 12181.

SENCORE SG165 stereo analyzer. Mint condition. Accessories and manuals \$400.00. COD. **A. JUNG**, 1203 Willow Ave., Bellevue, NE 68005 (402) 292-2785 evenings.

THE BEST PLACE TO BUY, SELL or
TRADE NEW and USED EQUIPMENT
NUTS & VOLTS MAGAZINE
BOX 1111-E • PLACENTIA, CA 92670
(714) 632-7721

Join Thousands of Readers Nationwide
Every Month

ONE YEAR U.S. SUBSCRIPTIONS

\$7.00 - 3rd Class • \$12.50 - 1st Class

• \$25.00 - Lifetime - 3rd Class

NUTS & VOLTS

HAM GEAR

COMPUTERS

SOFTWARE

SCANNERS • OPTICS

TEST EQUIPMENT

MICROWAVE

SATELLITE

AUDIO VISUAL

NEW PRODUCTS

COMPONENTS • KITS

ANTIQUE ELECT.

PUBLICATIONS

PLANS • SERVICES



WRITE FOR
McGEE'S
SPEAKER & ELECTRONICS CATALOG

1001 BARGAINS IN SPEAKERS

Tel.: 1 (816) 842 5092

1901 MCGEE STREET KANSAS CITY, MO. 64108

SATELLITE TV VIEWERS

Get the most complete weekly listings.
Send \$1 for sample copy.

Satellite TV Week

P.O. Box 308, Fortuna, California 95540
800-358-9997 (U.S.) • 800-556-8787 (Calif.)
707-725-2476 (all others)

TV, signal manual, covering UHF, cable, microwave, satellite. 150+ pages full of information. New info on the Orion-C converter for satellite owners. 24 hr. COD hotline (301) 668-7099. Or send \$21.95 + \$2.00 shipping to **TELE-PUBLICATIONS**, PO Box 16993, Baltimore, MD 21206.

PICTURE tube rebuilding equipment—we sell & buy new & used equipment. Free training. **ATOLL TELEVISION**, 6425 Irving Park, Chicago, IL 60634. Phone (312) 545-6667.

CABLE TV converter/descrambler. Lowest price anywhere. Oak N-12 or Jerrold SB-3 replacement \$79.00, combo with 35 channel converter \$139.00, Jerrold DRX-3DIC with remote \$179.00. Send \$2.00 with order or for catalog, refundable with your order to: **CK ELECTRONICS**, 397 Route 18 East, Suite 377, East Brunswick, NJ 08816, 201-739-2671.

PARABOLIC dishes 20" \$6.95 ea. 28" \$15.00 ea. includes bracket. Lots of 100 pcs. **VIKING PRECISION, INC.**, 4631 South 35th Place, Phoenix, AZ 85040 (602) 766-6218.

REVERBERATION FOR ORGANS

Solid state with controls for reverberation and room size.

EVERY ORGAN SHOULD OWN ONE.

Send for free flyer—

DEVTRONIX ORGANS, INC.
6101 WAREHOUSE WAY
SACRAMENTO, CALIFORNIA 95826 Dept. B

U-FIX-M Oak CA TV converters -M-26. Buy one get one free. \$19.95. **CABLE SALES**, 3868 Trade Ctr. Dr., Ann Arbor, MI 48104. COD or Certified Funds. Other converters available.

30 channel wired remote CA TV converter kits. Complete with everything. \$39.95. **CABLE SALES**, 3868 Trade Ctr. Dr., Ann Arbor, MI 48104. COD or Certified Funds. Other cvtrs. available.

ELECTRONIC touch light control pad. Write for free brochure. **EXOTIC IDEAS**, PO Box 446, Lake Bluff, IL 60044.

DELUXE STV modules gated pulse sine wave SAAV1 no internal connection to TV micro wave cable much more brochure \$2.00 refundable. **LEE-TRONIX**, Box 253, Taylor, MI 48180.

PICTURE flyer lists quality electronics surplus at low prices. Since 1970. Send for the last 3 issues. **STAR-TRONICS**, Box 683, McMinnville, OR 97128.

TELEVISION servicing equipment—**SAMS**—tubes— etc. Send large SASE for list. **MAURER**, 29 South 4th St., Lebanon, PA 17042.

LATEST bug-detection equipment for home or office. Literature, \$1.00. **CLIFTON**, Box 220-X, Miami, FL 33168.

AMAZING electronic devices! VOX's, miniature transmitters, telephone transmitters, wiretap defeats, and more! Send \$3.00 for catalog. **A.T.I.S.**, Dept. R, 61 Gatchell St., Buffalo, NY 14212.

FCC LOWERS REQUIREMENTS GET YOUR RADIO TELEPHONE LICENSE

FCC changes make obtaining High-Level Radio Telephone License much easier now. Eliminate unnecessary study, with our short cuts and easy to follow study material. Obtaining the General Radio Telephone License can be a snap! Sample exams, also section covering Radar Endorsement. A small investment for a high-paying career in electronics. \$19.95 ppd. Spi-Ro Distributors, P.O. Box 1538, Dept. R, Hendersonville, N.C. 28793.

APPLE IIe 64K RAM CARD

80 column x 24 lines

64K RAM

Compatible with
Apple IIe Software

\$149⁰⁰

PARALLEL INTERFACE EPSON TO APPLE

New From **\$49⁹⁵** CABLE INCLUDED
COEX

5 1/4" Floppy DISKETTES

All Certified-100% Guaranteed

BOX of 100... **\$149⁰⁰**
Above with
Hub Rings..... **\$169.00**

BMC 12" Green Monitor **\$95⁰⁰**

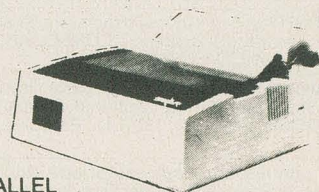
COEX 80-FT DOT MATRIX PRINTER

- 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing
- 2K Buffered Memory
- 80, 96, 132 Columns, Graphics and Block Printing
- Selectable Char Pitch, Line Spacing and Feed

PARALLEL

COEX Interface Card to Apple .. **\$49.95**

Commodore Interface Card to VIC, 64, PET..... **\$79.95**



\$240⁰⁰

for **APPLE**

16K RAM CARD

Language Transparent
COEX FACTORY WARRANTY **\$49⁹⁵**

EXTENDER CARDS

for APPLE... **\$16.95**

for I.B.M.... **\$19.95**

FLOPPY DISK DRIVE

Apple IIe Compatible

- with • Track Zero Micro Switch
- DOS 3.2.1 & DOS 3.3
- CP/M and PASCAL

DESIGNED FOR YOUR **\$235⁰⁰**
APPLE™

Controller Card
for above..... **\$75.00**

DO YOU HAVE A COMMODORE?

NEW ROM for COEX 80 & DP8480

Allows Full Graphics Compatibility
with All Commodore Computers **\$29⁹⁵**

Now You Can Afford Another 64K...

**Especially when it's less than
a half cent per bit!**

Specifications:

- Fully Static Operation
- Supports S-100 IEEE-696 Standards
- Uses Popular 2716 Pinout Type Static RAM's
- Board Access Time Under 200nS
- 150nS RAMS Standard
- No Wait States Needed at 6.000MHz
- High Quality FR-4 Type PC Board
- Switch Selectable Phantom Line
- All Data, Status and Address Lines Fully Buffered
- Gold Plated Contact Fingers for Low Contact Resistance and Long Life
- Switch Selectable Extended Address Lines For Up To 16 M-bytes
- Extreme Low Power Dissipation (<500mA Typical)
- Top 8K May Be Switched Disabled and/or Interchangeable with 2716 Type EPROM's

COEX 64K S-100 CMOS

STATIC RAM BOARD

\$299⁰⁰

only

Assembled & Tested



"Have You Kissed Your Computer Lately?"

Components Express, Inc.

1380 E. Edinger • Santa Ana, Calif. 92705 • 714/558-3972

TWX 910-595-1565 • ADVACON SNA • International Orders Welcome

Terms of Sale: Cash, Checks, Credit Cards, M.O., C.O.D. Calif. residents add 6% sales tax.

CIRCLE 88 ON FREE INFORMATION CARD



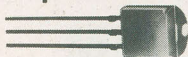
RADIO SHACK IS AMERICA'S PARTS PLACE™

High Quality!

Wide Selection!

Low Prices!

Replacement Transistors



Type		Cat. No.	Each
2N1305	PNP	276-2007	1.19
MPS222A	NPN	276-2009	.79
PN2484	PNP	276-2010	.89
MPS3904	NPN	276-2016	.69
TIP31	NPN	276-2017	.99
TIP3055	NPN	276-2020	1.59
MPS2907	PNP	276-2023	.79
MJE34	PNP	244-2027	1.49
2N3053	NPN	276-2030	.89
MPS3638	PNP	276-2032	.79
TIP120	NPN	276-2068	1.29
2N3055	NPN	276-2041	1.99
MJ2955	PNP	276-2043	2.19
2N4124	NPN	276-2057	.59
2N4401	NPN	276-2058	.59
MPSA06	NPN	276-2059	.59
MPSA13	NPN	276-2060	.59
MPSA42	NPN	276-2061	.69
MU4891	UJT	276-2029	.99
2SD313	NPN	276-2048	1.79
2SC945	NPN	276-2051	.79
2SC1308	NPN	276-2055	7.95
2N3819	N-FET	276-2035	.99
MPF102	N-FET	276-2062	.99

4000-Series CMOS ICs



With Pin-Out
And Specs

Type	Cat. No.	Each
4001	276-2401	.79
4011	276-2411	.79
4013	276-2413	.99
4017	276-2417	1.49
4023	276-2423	.99
4049	276-2449	.99
4066	276-2466	.99

TTL Digital ICs

With Pin-Out and Specs

Type	Cat. No.	Each
7400	276-1801	.59
7404	276-1802	.79
7408	276-1822	.79
7447	276-1805	1.19
7490	276-1808	.89

Operational Amplifiers



Type		Cat. No.	Each
741	(Single)	276-007	.79
MC1458	(Dual)	276-038	.99
LM324	(Quad)	276-1711	1.29
TL082	(Dual)	276-1715	1.89
TL084C	(Quad)	276-1714	2.99
LM3900	(Quad)	276-1713	1.39
LM339	(Quad)	276-1712	1.49

Voltage Regulator ICs



Type	Adjustable	Cat. No.	Each
LM723	0 to 40 VDC	276-1740	.89
LM317T	1.2 to 37 VDC	276-1778	2.79
Type	Fixed Output	Cat. No.	Each
7805	+5 VDC	276-1770	1.59
7812	+12 VDC	276-1771	1.59
7815	+15 VDC	276-1772	1.59
7905	-5 VDC	276-1773	1.59
7912	-12 VDC	276-1774	1.59

Computer Connectors

Type	Positions	Cat. No.	Each
ID Card Edge	34	276-1564	4.95
ID Card Edge	50	276-1566	4.95
Card-Edge Socket	44	276-1551	2.99
ID D-Sub Male	25	276-1559	4.99
ID D-Sub Female	25	276-1565	4.99
Solder D-Sub Male	25	276-1547	2.99
Solder D-Sub Female	25	276-1548	3.99
Hood	—	276-1549	1.99
D-Sub Solder Male	9	276-1537	1.99
D-Sub Solder Female	9	276-1538	2.49
Hood	—	276-1539	1.99

Tantalum Capacitors

- 20% Tolerance
- Standard IC Pin Spacing

μF	WVDC	Cat. No.	Each
0.1	35	272-1432	.49
0.47	35	272-1433	.49
1.0	35	272-1434	.49
2.2	35	272-1435	.59
10	16	272-1436	.69
22	16	272-1437	.79

Power Transformers

120VAC Primaries

Type	Volts	Current	Cat. No.	Each
Mini	6.3	300 mA	273-1384	2.59
Mini	12.0	300 mA	273-1385	2.79
Mini	24.0	300 mA	273-1386	2.99
Mini	12.0 CT	450 mA	273-1365	3.59
Mini	24.0 CT	450 mA	273-1366	3.99
Std.	6.3	1.2A	273-050	3.79
Std.	12.6 CT	1.2A	273-1505	3.99
Std.	25.2	1.2A	273-1480	4.39
H-D	12.6 CT	3.0A	273-1511	5.99
H-D	25.2 CT	2.0A	273-1512	6.29
H-D	18.0 CT	2.0A	273-1515	6.99

1/4-Watt, 5% Resistors

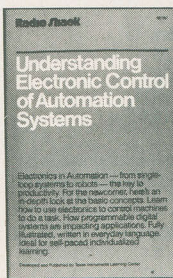
39¢ Pkg. of 5

Ohms	Cat. No.	Ohms	Cat. No.
10	271-1301	10k	271-1335
100	271-1311	15k	271-1337
150	271-1312	22k	271-1339
220	271-1313	27k	271-1340
270	271-1314	33k	271-1341
330	271-1315	47k	271-1342
470	271-1317	68k	271-1345
1k	271-1321	100k	271-1347
1.8k	271-1324	220k	271-1350
2.2k	271-1325	470k	271-1354
3.3k	271-1328	1 meg	271-1356
4.7k	271-1330	10 meg	271-1365
6.8k	271-1333	—	—

Learn All About Robotics!

NEW! 295

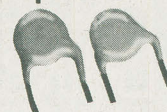
Fully illustrated and written in everyday language, this 256-page book covers everything from single-loop systems to complex robots used in industry. Learn how electronics can control machines and increase productivity. **62-1387 2.95**



Ceramic Disc Capacitors

For RF, Bypass and Coupling Applications

Low As **39¢** Pkg. of 2



Moisture-proof coating. Hi-Q design for low loss in RF circuits. 50 WVDC minimum.

pF	Cat. No.	Pkg. of 2	μF	Cat. No.	Pkg. of 2
4.7	272-120	.39	.001	272-126	.39
47	272-121	.39	.005	272-130	.39
100	272-123	.39	.01	272-131	.39
220	272-124	.39	.05	272-134	.49
470	272-125	.39	.1	272-135	.49

Miniature PC-Mount Potentiometers



1/8-Watt, Horizontal-Mount

Ohms	Cat. No.	Each
1k	271-333	.49
10k	271-335	.49
25k	271-336	.49
100k	271-338	.49
500k	271-339	.49

1/4-Watt, Vertical-Mount

Ohms	Cat. No.	Each
500	271-226	.59
1k	271-227	.59
5k	271-217	.59
10k	271-218	.59
50k	271-219	.59
100k	271-220	.59
500k	271-221	.59
1 meg	271-229	.59

Micro-Mini Toggle Switches



Top quality! Rated 3 amps at 125 VAC. Body: 1/4 x 5/16 x 3/16". Mounting hole: 3/8". Solder lugs.

Type	Cat. No.	Each
SPST	275-624	1.49
SPDT	275-625	1.59
DPDT	275-626	1.89

Flatted-Lever Switches



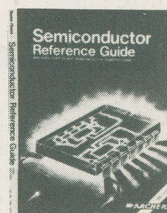
Rated 6 amps at 125VAC. Body: 3/8 x 7/16 x 1/4". Require 1/4" mounting holes.

Type	Cat. No.	Each
SPDT	275-635	2.39
DPDT	275-636	2.69

DPDT Momentary. Same size and rating as above, with spring return to center-off position. **275-637 2.89**

Semiconductor Reference Guide 349

1984 Edition. Exclusive cross-reference and substitution section lists over 80,000 types and their low-cost Radio Shack equivalents. Also provides detailed data on Radio Shack ICs, SCRs, LEDs, diodes and opto devices. Helpful replacement tips, too. Illustrated. Over 200 pages. **276-4007 3.49**



OVER 8800 LOCATIONS WORLDWIDE

Radio Shack®

A DIVISION OF TANDY CORPORATION

Prices apply at participating Radio Shack stores and dealers

CIRCLE 61 ON FREE INFORMATION CARD

NOVEMBER 1983

125

Special Projects
The magazine for people who build electronic projects

By the Publishers of
Radio-Electronics

48784
U.S.
\$2.25
FALL 1983
#8
CANADA
\$2.75

Satellite Receiving Projects
Build your own TVRO Dish Rotator
Pull 'em all in!

BONUS PROJECT
Dynamic Noise Reduction System for Hi-Fi

2 Satellite Stereo Projects

UP-1 RF Converter

M-1 Matrix Stereo Decoder

High-Speed Touch-Control Joystick for your Atari

Varyvolt Power Supply for CMOS and TTL Projects

One-Bander Shortwave Converter for your Car

GERNSBACK PUBLICATION

INTRODUCING OUR NEW SUBSCRIPTION OFFER!

**Become a
Charter Member
Subscriber!**

Get every issue!

**SUBSCRIBE
TODAY!**

**Use the order
form below.**

Subscribe Today!

■ IF YOU'RE THE KIND OF READER that doesn't want to wait, you can order your next copy of **Special Projects** now. **Special Projects** is crammed full of electronic projects that you won't be able to wait to build for yourself. You can expect top-notch digital projects, fun-to-play electronic games, valuable add-on computer projects, BCB and shortwave receivers, photographic/darkroom gadgets, devices to improve your car's performance, test equipment ideas, and more in every jam-packed issue of **Special Projects**.

■ TO HELP YOU TO BE SURE that you don't miss any future issues of **Special Projects**—SUBSCRIPTIONS ARE NOW AVAILABLE!

■ YOU CAN HAVE THE NEXT FOUR ISSUES of **Special Projects** delivered directly to your home for only \$9.00. We pay the postage. If you want the next eight issues, you can even save a dollar off the newsstand price. Get eight issues for \$17.00.

■ EVERY ISSUE OF SPECIAL PROJECTS will continue to contain a variety of construction articles to suit every taste. In addition, feature articles on electronics fundamentals, test equipment and tools will round out each issue. Of course, we will continue to provide new product and literature listings to keep you up to date on the latest developments in electronic technology.

■ GET IN ON THE ACTION! Order your next issue of **Special Projects** today. Use the convenient order coupon below.

Special Projects SUBSCRIPTION

Detach and mail today to:
SPECIAL PROJECTS
SUBSCRIPTION DEPT.
200 PARK AVE. SOUTH
NEW YORK, N.Y. 10003

CASH WITH ORDER ONLY RE 11-83
Allow 6-8 weeks for the first issue to arrive.

Please print

(Name)

(Street Address)

(City)

(State)

(Zip)

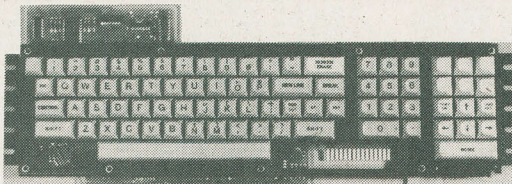
DSP

☐ I want to be sure I don't miss any issues. Send me the next four issues of **Special Projects** for \$9.00: starting with #9. Postage is free in U.S. For Canada add \$3.00. Foreign add \$7.00.

☐ I want to be sure I don't miss any issues and want to save \$1.00 too. Send me the next eight issues of **Special Projects** for \$17.00: Starting with #9. Postage is free in U.S. For Canada add \$6.00. Foreign add \$14.00.

☐ Send me _____ copies of **Special Projects** #9 at \$2.25 plus \$1.00 postage and handling for US, Canada and Mexico. U.S. funds only. All other countries add \$2.00.

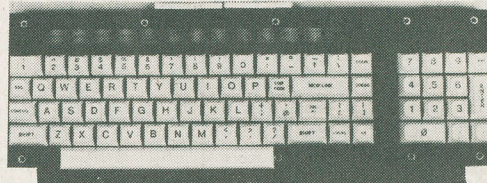
UNENCODED & ASCII ENCODED KEYBOARDS



71-KEY UNENCODED CHERRY KEYBOARD

- Unencoded • Cursor keypad • SPST mechanical keyswitches
- 74150-154 matrix encoder/decoder • 15/30 card-edge connector
- Color: Main and numeric keyboard - orange, Cursor keypad - yellow
- Size: 18"L x 6 3/4"W x 1 1/2"H • Fits DTE-20 enclosure

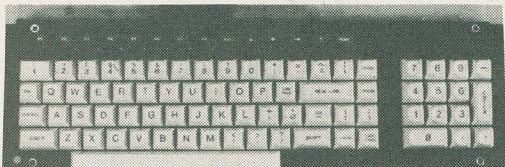
Part No. KB4700 (107 available) \$21.95



73-KEY UNENCODED CHERRY KEYBOARD

- 14-Key numeric keypad • SPST mechanical keyswitches • Two 22-pin strip socket connectors • Color: white • Size: 15 1/2"L x 6 1/4"W x 1 1/2"H • Fits DTE-20 enclosure

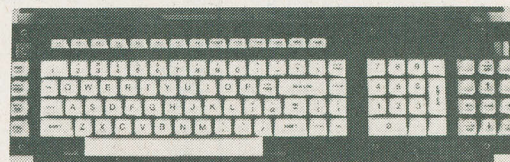
Part No. KB6300 (250 available) \$19.95



87-KEY UNENCODED KEYBOARD

- 14-Key numeric keypad • Cursor keys • SPST mechanical keyswitches • 40-pin header connector • Color: Main & numeric keyboard - white, Cursor and function keys - brown • Size: 16 1/2"L x 6"W x 1 1/4"H • Fits DTE-20 enclosure

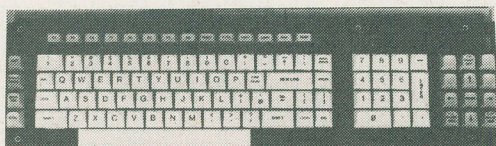
Part No. KB9610 (130 available) \$23.95



99-KEY UNENCODED CHERRY KEYBOARD

- Numeric keypad • Cursor keypad • SPST mechanical keyswitches • Two 22-pin strip socket connectors • Color: Main and numeric - white, Cursor and function keys - grey • Size: 19 1/8"L x 6 1/8"W x 1 1/2"H • Fits DTE-22 enclosure

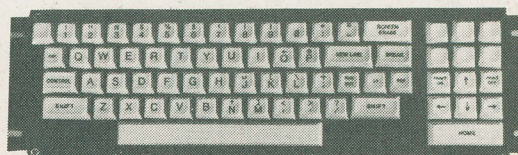
Part No. KB6001 (160 available) \$26.95



103-KEY UNENCODED CHERRY KEYBOARD

- Numeric keypad • Cursor keypad • SPST mechanical keyswitches • 40-pin header connector • Color: Main and numeric keyboard - white, Cursor and function keys - grey • Size: 19 1/8"L x 5 1/8"W x 1 1/2"H • Fits DTE-22 enclosure

Part No. KB7000 (707 available) \$29.95



60-KEY ASCII CHERRY KEYBOARD

- Cursor keypad • SPST mechanical keyswitches • 20-pin header connector • Color: Main keyboard - orange, Cursor keypad - yellow • Size: 15 3/8"L x 4 1/2"W x 2 1/4"H • Fits DTE-20 enclosure

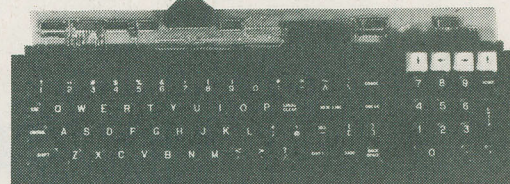
Part No. KB2301 (107 available) \$24.95



ASCII 71-KEY CHERRY KEYBOARD

- 11-Key numeric keypad • Cursor keypad • SPST mechanical keyswitches • 15/30 card-edge connector • Color: Main keyboard - white, Cursor keypad - off-white • Size: 18"L x 7"W x 1 1/2"H

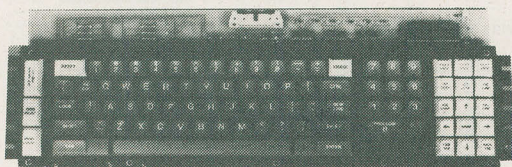
Part No. KB1801 (525 available) \$29.95



77-KEY ASCII KEYTRONICS KEYBOARD

- 13-Key numeric keypad • Mechanical keyswitches • 26-pin header connector • Color: Main and numeric keyboard - black, Cursor - grey • Size: 17"L x 6"W x 1 1/4"H • Fits DTE-20 enclosure

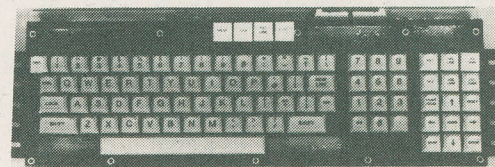
Part No. KB1003 (135 available) \$34.95



87-KEY ASCII KEYBOARD

- Manufactured by Cherry • SPST switches • 26-pin header connector • Color: Main and numeric keypad - grey, Cursor keypad - white • Size: 19"L x 6 1/4"W x 1 1/2"H • Fits DTE-20 enclosure

Part No. KB3300 . (530 avail.) . \$39.95



87-KEY ASCII KEYBOARD

- Manufactured by Cherry • SPST switches • 40-pin header connector • Color: Main and numeric keypad - orange, Cursor keypad - yellow • Size: 18"L x 6 1/4"W x 1 1/2"H • Fits DTE-20 enclosure

Part No. KB8700 . (192 avail.) . \$29.95

\$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6 1/2 % Sales Tax
Shipping — Add 5 % plus \$1.50 Insurance
Send S.A.S.E. for Monthly Sales Flyer!



Mail Order, Electronics - Worldwide
**Jameco
ELECTRONICS**



1355 SHOREWAY ROAD, BELMONT, CA 94002
11/83 Phone Orders Welcome (415) 592-8097 Telex: 176043

CIRCLE 41 ON FREE INFORMATION CARD

7400

Part No.	**Pins	Price	Part No.	**Pins	Price	Part No.	**Pins	Price
SN7400N	14	25	SN7472N	14	29	SN74156N	16	59
SN7401N	14	25	SN7473N	14	35	SN74160N	16	59
SN7402N	14	25	SN7474N	14	35	SN74161N	16	59
SN7403N	14	25	SN7475N	14	45	SN74162N	16	59
SN7404N	14	25	SN7476N	16	35	SN74163N	16	59
SN7405N	14	25	SN7477N	14	45	SN74164N	16	59
SN7406N	14	45	SN7478N	14	49	SN74165N	16	59
SN7407N	14	45	SN7479N	14	49	SN74166N	16	59
SN7408N	14	25	SN7480N	14	49	SN74167N	16	59
SN7409N	14	25	SN7481N	14	49	SN74168N	16	59
SN7410N	14	25	SN7482N	14	49	SN74169N	16	59
SN7411N	14	25	SN7483N	16	59	SN74170N	16	59
SN7412N	14	25	SN7484N	16	59	SN74171N	16	59
SN7413N	14	25	SN7485N	16	59	SN74172N	16	59
SN7414N	14	25	SN7486N	16	59	SN74173N	16	59
SN7415N	14	25	SN7487N	16	59	SN74174N	16	59
SN7416N	14	25	SN7488N	16	59	SN74175N	16	59
SN7417N	14	25	SN7489N	16	59	SN74176N	16	59
SN7418N	14	25	SN7490N	14	39	SN74177N	16	59
SN7419N	14	25	SN7491N	14	39	SN74178N	16	59
SN7420N	14	25	SN7492N	14	39	SN74179N	16	59
SN7421N	14	25	SN7493N	14	39	SN74180N	16	59
SN7422N	14	25	SN7494N	14	39	SN74181N	16	59
SN7423N	14	25	SN7495N	14	39	SN74182N	16	59
SN7424N	14	25	SN7496N	14	39	SN74183N	16	59
SN7425N	14	25	SN7497N	16	35	SN74184N	16	59
SN7426N	14	25	SN7498N	16	35	SN74185N	16	59
SN7427N	14	25	SN7499N	16	35	SN74186N	16	59
SN7428N	14	25	SN7500N	14	29	SN74187N	16	59
SN7429N	14	25	SN7501N	14	29	SN74188N	16	59
SN7430N	14	25	SN7502N	14	29	SN74189N	16	59
SN7431N	14	25	SN7503N	14	29	SN74190N	16	59
SN7432N	14	25	SN7504N	14	29	SN74191N	16	59
SN7433N	14	25	SN7505N	14	29	SN74192N	16	59
SN7434N	14	25	SN7506N	14	29	SN74193N	16	59
SN7435N	14	25	SN7507N	14	29	SN74194N	16	59
SN7436N	14	25	SN7508N	14	29	SN74195N	16	59
SN7437N	14	25	SN7509N	14	29	SN74196N	16	59
SN7438N	14	25	SN7510N	14	29	SN74197N	16	59
SN7439N	14	25	SN7511N	14	29	SN74198N	16	59
SN7440N	14	25	SN7512N	14	29	SN74199N	16	59
SN7441N	14	25	SN7513N	14	29	SN74200N	16	59
SN7442N	14	25	SN7514N	14	29	SN74201N	16	59
SN7443N	14	25	SN7515N	14	29	SN74202N	16	59
SN7444N	14	25	SN7516N	14	29	SN74203N	16	59
SN7445N	14	25	SN7517N	14	29	SN74204N	16	59
SN7446N	14	25	SN7518N	14	29	SN74205N	16	59
SN7447N	14	25	SN7519N	14	29	SN74206N	16	59
SN7448N	14	25	SN7520N	14	29	SN74207N	16	59
SN7449N	14	25	SN7521N	14	29	SN74208N	16	59
SN7450N	14	25	SN7522N	14	29	SN74209N	16	59
SN7451N	14	25	SN7523N	14	29	SN74210N	16	59
SN7452N	14	25	SN7524N	14	29	SN74211N	16	59
SN7453N	14	25	SN7525N	14	29	SN74212N	16	59
SN7454N	14	25	SN7526N	14	29	SN74213N	16	59
SN7455N	14	25	SN7527N	14	29	SN74214N	16	59
SN7456N	14	25	SN7528N	14	29	SN74215N	16	59
SN7457N	14	25	SN7529N	14	29	SN74216N	16	59
SN7458N	14	25	SN7530N	14	29	SN74217N	16	59
SN7459N	14	25	SN7531N	14	29	SN74218N	16	59
SN7460N	14	25	SN7532N	14	29	SN74219N	16	59
SN7470N	14	25	SN7533N	14	29	SN74220N	16	59

74LS

Part No.	**Pins	Price	Part No.	**Pins	Price	Part No.	**Pins	Price
SN74LS00N	14	25	SN74LS72N	14	29	SN74LS156N	16	59
SN74LS01N	14	25	SN74LS73N	14	35	SN74LS160N	16	59
SN74LS02N	14	25	SN74LS74N	14	35	SN74LS161N	16	59
SN74LS03N	14	25	SN74LS75N	14	45	SN74LS162N	16	59
SN74LS04N	14	25	SN74LS76N	16	35	SN74LS163N	16	59
SN74LS05N	14	25	SN74LS77N	14	45	SN74LS164N	16	59
SN74LS06N	14	25	SN74LS78N	14	49	SN74LS165N	16	59
SN74LS07N	14	25	SN74LS79N	14	49	SN74LS166N	16	59
SN74LS08N	14	25	SN74LS80N	14	49	SN74LS167N	16	59
SN74LS09N	14	25	SN74LS81N	14	49	SN74LS168N	16	59
SN74LS10N	14	25	SN74LS82N	14	49	SN74LS169N	16	59
SN74LS11N	14	25	SN74LS83N	16	59	SN74LS170N	16	59
SN74LS12N	14	25	SN74LS84N	16	59	SN74LS171N	16	59
SN74LS13N	14	25	SN74LS85N	16	59	SN74LS172N	16	59
SN74LS14N	14	25	SN74LS86N	16	59	SN74LS173N	16	59
SN74LS15N	14	25	SN74LS87N	16	59	SN74LS174N	16	59
SN74LS16N	14	25	SN74LS88N	16	59	SN74LS175N	16	59
SN74LS17N	14	25	SN74LS89N	16	59	SN74LS176N	16	59
SN74LS18N	14	25	SN74LS90N	14	39	SN74LS177N	16	59
SN74LS19N	14	25	SN74LS91N	14	39	SN74LS178N	16	59
SN74LS20N	14	25	SN74LS92N	14	39	SN74LS179N	16	59
SN74LS21N	14	25	SN74LS93N	14	39	SN74LS180N	16	59
SN74LS22N	14	25	SN74LS94N	14	39	SN74LS181N	16	59
SN74LS23N	14	25	SN74LS95N	14	39	SN74LS182N	16	59
SN74LS24N	14	25	SN74LS96N	14	39	SN74LS183N	16	59
SN74LS25N	14	25	SN74LS97N	16	35	SN74LS184N	16	59
SN74LS26N	14	25	SN74LS98N	16	35	SN74LS185N	16	59
SN74LS27N	14	25	SN74LS99N	16	35	SN74LS186N	16	59
SN74LS28N	14	25	SN7500N	14	29	SN74LS187N	16	59
SN74LS29N	14	25	SN7501N	14	29	SN74LS188N	16	59
SN74LS30N	14	25	SN7502N	14	29	SN74LS189N	16	59
SN74LS31N	14	25	SN7503N	14	29	SN74LS190N	16	59
SN74LS32N	14	25	SN7504N	14	29	SN74LS191N	16	59
SN74LS33N	14	25	SN7505N	14	29	SN74LS192N	16	59
SN74LS34N	14	25	SN7506N	14	29	SN74LS193N	16	59
SN74LS35N	14	25	SN7507N	14	29	SN74LS194N	16	59
SN74LS36N	14	25	SN7508N	14	29	SN74LS195N	16	59
SN74LS37N	14	25	SN7509N	14	29	SN74LS196N	16	59
SN74LS38N	14	25	SN7510N	14	29	SN74LS197N	16	59
SN74LS39N	14	25	SN7511N	14	29	SN74LS198N	16	59
SN74LS40N	14	25	SN7512N	14	29	SN74LS199N	16	59
SN74LS41N	14	25	SN7513N	14	29	SN74LS200N	16	59
SN74LS42N	14	25	SN7514N	14	29	SN74LS201N	16	59
SN74LS43N	14	25	SN7515N	14	29	SN74LS202N	16	59
SN74LS44N	14	25	SN7516N	14	29	SN74LS203N	16	59
SN74LS45N	14	25	SN7517N	14	29	SN74LS204N	16	59
SN74LS46N	14	25	SN7518N	14	29	SN74LS205N	16	59
SN74LS47N	14	25	SN7519N	14	29	SN74LS206N	16	59
SN74LS48N	14	25	SN7520N	14	29	SN74LS207N	16	59
SN74LS49N	14	25	SN7521N	14	29	SN74LS208N	16	59
SN74LS50N	14	25	SN7522N	14	29	SN74LS209N	16	59
SN74LS51N	14	25	SN7523N	14	29	SN74LS210N	16	59
SN74LS52N	14	25	SN7524N	14	29	SN74LS211N	16	59
SN74LS53N	14	25	SN7525N	14	29	SN74LS212N	16	59
SN74LS54N	14	25	SN7526N	14	29	SN74LS213N	16	59
SN74LS55N	14	25	SN7527N	14	29	SN74LS214N	16	59
SN74LS56N	14	25	SN7528N	14	29	SN74LS215N	16	59
SN74LS57N	14	25	SN7529N	14	29	SN74LS216N	16	59
SN74LS58N	14	25	SN7530N	14	29	SN74LS217N	16	59
SN74LS59N	14	25	SN7531N	14	29	SN74LS218N	16	59
SN74LS60N	14	25	SN7532N	14	29	SN74LS219N	16	59
SN74LS70N	14	25	SN7533N	14	29	SN74LS220N	16	59

MICROPROCESSOR COMPONENTS

MICROPROCESSOR CHIPS			DYNAMIC RAMS		
Part No.	**Pin Function	Price	Part No.	**Pins	Price
CDP1802	40 CPU	\$2.95	1103	18 1024x1 (30ns)	1.89
MCS5602B	40 MPU w/ CLK at 3MHz	7.95	4027	18 1024x1 (250ns)	1.89
MCS6802C	40 CPU w/ 8KB and RAM	5.95	4119N-2	16 16.384x1 (150ns)	1.69
MS8035N-6	40 MPU - 8 bit (6MHz)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-6	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (200ns)	1.69
MS8039N-7	40 CPU-Sgl. chkl bit (128 bits. Ram)	5.95	4119N-3	16 16.384x1 (20	

COMPUTER-PERIPHERAL SWITCHES

Connect any number of peripherals to a single I/O port — use a single printer to support several microcomputers — use two or more printers to support a single microcomputer — access a modem from any of several microcomputers — Ideal for demonstrating or comparing equipment. The Selecto-Switches are designed to eliminate the unnecessary plugging & unplugging of cables which connect printers, terminals, or modems to various computers. By using a Selecto-Switch, you achieve more efficient system operation, better utilization of peripherals & computer ports, eliminate redundant hardware & reduce service calls. 5 yr. limited warranty on all Selecto-Switches. No power required. Size (inches): 10L x 7W x 3H, 2 1/2 lbs.

RS232 SERIAL SELECTO-SWITCH

• Switches all lines of asynchronous data • Easy expansion of serial ports • Connectors are female DB25 type

PART NO.	DESCRIPTION	PRICE
GRS232-AB	2-Way Switch	\$139.95
GRS232-ABC	3-Way Switch	\$179.95

DB25 PARALLEL SELECTO-SWITCH

• TRS-80, Apple, and IBM compatible • Switches 24 lines (line 1 is ground) • Connectors are female DB25 type

PART NO.	DESCRIPTION	PRICE
GP24-AB	2-Way Switch	\$139.95
GP24-ABC	3-Way Switch	\$179.95

CENTRONICS-STYLE SELECTO-SWITCH

• Switches all 36 lines • Connectors are female Centronics

PART NO.	DESCRIPTION	PRICE
GCENT-AB	2-Way Switch	\$199.95
GCENT-ABC	3-Way Switch	\$229.95

Micro-Logic Corp. MICRO-CHARTS

• Fully decoded data • Instant access • 2-sided, totally comprehensive • Compact 8 1/2 x 11 in. durable credit card plastic • Perfect for engineers • Clear & concise tables for: full instruction set, disassembly, ASCII, base conversion, effect of flags, compare vs. jump, interrupt structure, pinout, cycle times, diagrams, bug notes, & much more...

PART NO.	REFERENCE	PRICE
ML-280	Z80 CPU	\$5.95
ML-8080A	8080A/8085A	\$5.95
ML-6502	6502 (65XX)	\$5.95
ML-8048	8048, Relatives	\$5.95
ML-7400	5400/7400 TTL Pin-Outs	\$5.95

BOOKS

30001	National CMOS Data Book (1981) (640 pages) 74C, CD4000, and A/D Converters	\$6.95
30003	National Linear Data Book (1982) (1376 pages) LM, LF, DAC, ADC, LH Series	\$11.95
30008	National Memory Data Book (1980) (464 pages) RAMs, ROMs, PROMs, EPROMs Series	\$6.95
30009	Intersil Data Book (1983) (1356 pages) Complete line.	\$9.95
30010	National Audio/Radio Handbook (1980) (240 pages) Pre-Amps, AM, FM & FM Stereo, Power Amps	\$5.95
30012	National PAL Data Book (1982) (176 pages) Application Notes, Linear Briefs, etc.	\$5.95
30013	Zilog Data Book (1983) (641 pages) Microprocessors and Support Chips	\$7.95
210830	Intel Memory Components Handbook (1983) (798 pages) Contains all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs, EPRoMs & Bubble Memories	\$14.95
210844	Intel Microprocessor & Peripheral Handbook (1983) (1027 pages) Contains Data Sheets on all of Intel's Microprocessors and Peripherals	\$14.95

ATARI — COMMODORE

ATARI PADDLE

JSP \$2.49/pair

COMMODORE PADDLE

CSP VIC20-C64 \$3.95/pair

TV GAME SWITCH

Used on Atari. Cosmetically blemished. 100% functional.

TGS-1 \$1.95 ea.

Jameco Electronics Digital Thermometer Kit

Dual sensors — switch controls for indoor/outdoor or dual monitoring — can be extended to 500 feet. Continuous LED 8° ht. display. Range: -40°F to 199°F, -40°C to 100°C. Accuracy: ±1° nominal. Calibrate for Fahrenheit/Celsius. Simulated walnut case. AC wall adapter included. Size: 6 1/2" L x 3 1/4" W x 1 1/2" D.

JE300 \$39.95

Universal Computer Keyboard Enclosures

DTE-8	Panel Width 7.5"	\$24.95
DTE-11	Panel Width 10.13"	\$27.95
DTE-14	Panel Width 13.5"	\$29.95
DTE-20	Panel Width 19.25"	\$34.95
DTE-22	Panel Width 21.375"	\$39.95

ACCESSORIES FOR APPLE* COMPUTERS

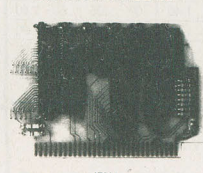
Numeric/Auxiliary Keypad for APPLE IIe*



The JE614 is a newly introduced numeric/auxiliary keypad for the APPLE IIe. It offers the flexibility of a 10-key pad and the convenience of 23 directly accessible functions. Screen manipulating functions make word processing a snap and cursor controls make the keypad ideal for VisiCalc™ users. The JE614 Keypad is housed in a durable metal enclosure and is color-coordinated with your APPLE IIe computer. Operation of the keypad can begin within minutes from unpacking. Special functions include: Home, Clear, Clear to End of Screen, Scroll Up, Scroll Down, Tab, Delete, Left, Right, Up and Down. Each key has auto-repeat.

JE614 Assembled and Tested \$89.95

Extended 80 Column/64K RAM Card for APPLE IIe*



Now you can double the memory capacity and get an 80 column display format for your APPLE IIe computer at an affordable price. Just plug the JE664 card into your APPLE IIe and expand your display to 80 characters per line. Perfect for word processing. The JE664 also features 64K bytes of additional memory to allow programming not possible with standard APPLE IIe computers.

Board: High density board design assures 64K bytes of RAM onto a 2 1/2" x 4 1/2" board • Fully tested to assure proper operation.

Uses: Word processing — displays 1000 more characters per screen • Extra memory allows running of extremely large programs • Ultra High Resolution Graphics (software available).

JE664 Assembled and Tested \$149.95

Switching Power Supply for APPLE II, II+ and IIe*

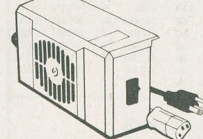


• Can drive four floppy disk drives and up to eight expansion cards • Short-circuit and overload protection • Fits inside Apple computer enclosure • Fully regulated • +5V @ 5A, +12V @ 3A, +5V @ 5A, +12V @ 5A • Apple-type plug in power cord included • Size: 9 1/2" L x 3 1/2" W x 2 1/4" H • Weight: 2 lbs.

Part No. KHP4007 \$79.95

*APPLE and APPLE IIe are registered trademarks of APPLE Computer, Inc. • VisiCalc is a registered trademark of Visi Corp. Inc.

Cooling Fan for APPLE II, II+ and IIe*



• Snaps on the side of APPLE II, II+ and IIe enclosures • Eliminates overheating problems, thereby boosting reliability and operation life of computer • Switch on front of fan serves as power switch for fan computer, and provides extra outlet.

Part No. APP-1 \$49.95

5 1/4" HALF-HEIGHT DISK DRIVES

FIT TWO DRIVES IN THE SAME SPACE AS ONE CONVENTIONAL 5 1/4" DRIVE

TEAC FD55A

COMPATIBLE WITH TRS-80 IBM-PC

SHUGART SA455

SINGLE-SIDED:

- 48 lpi
- 40 Tracks
- 250Kbytes single-sided
- Single/double density
- Brushless DC direct-drive motor
- Power req.: +12VDC @ 3A +5VDC @ .55A
- 6 msec. track to track
- One year warranty
- Size: 5 1/2" W x 1 1/4" H x 8" D
- Weight: 3 lbs. 5 oz.

FD55A \$249.95

DOUBLE-SIDED:

- 48 lpi
- 40 Tracks
- 500Kbytes double-sided
- Single/double density
- Brushless DC direct-drive motor
- Power req.: +12VDC @ .75A +5VDC @ .7A
- 6 msec. track to track
- Compatible with SA400/450
- One year warranty
- Size: 5 7/8" W x 1 1/4" H x 8" D
- Weight: 3.3 lbs.

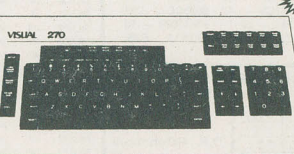
Shugart SA455

SA455 \$259.95

Keytronics 90-Key Keyboard

WITH SECURITY KEYLOCK SWITCH

- RFI shielded
- Cursor controls
- Numeric keyboard
- 8-bit Parallel
- Solid state switches
- 10 user-programmable keys
- Positive TTL Logic
- Size: 17" L x 8 1/4" W x 2 1/4" H



Made for Visual Technology, this keyboard features: a security keylock (includes two keys) to guard against unauthorized use; an 11-key numeric keypad; cursor controls; and 10 user-programmable keys. Electrical requirements: +5VDC. Color (case): White, Color (keycaps): Black. Complete with case, keyboard assembly, 40-inch interface cable, and schematics. Weight: 7 lbs.

Part No. KB270 \$79.95 each

MICRO SWITCH 85-KEY KEYBOARD

Word Processing Keyboard, 26 Pin Edge Card Connection. Supply Voltage +5VDC. Main Keyboard is QWERTY. Additional Key Pads for Cursor and word processing functions. Part No. 85SD18-1 \$29.95 each

HI-TEK 14-KEY NUMERIC KEYPAD

SPST switching. Charcoal grey keycaps. Mounted on printed circuit board. Part No. K-14 \$9.95 each

POWER SUPPLY +5VDC @ 1 AMP REGULATED

Transaction Tech Output: +5VDC @ 1A (also +30VDC) reg. Input: 115VAC 60Hz. 2-tone (black/belt) self-enclosed case. 6 ft. 3 cond. black power cord. 6 1/2" W x 7 1/2" D x 2 1/4" H. 3 lbs. Data sheet incl. Part No. PS51194S \$14.95 each

POWER SUPPLY +5VDC @ 3 AMP REGULATED

Deltion Input: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp. 6VDC @ 2.5 amp. Adjustable current limit. Ripple & Noise: 10V rms. 50V p-p — 2 mounting surfaces. UL recognized. Size: 4 1/2" L x 2 1/8" W x 1 1/2" H. 2 lbs. Data sheet included. Part No. QPS-1 \$29.95 each

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Input: 115VAC, 50-60Hz; Output: 5VDC @ 7.5 amp, 12VDC @ 1.5 amp. Fan cool. Power supply select switch (115/230VAC). Output: 5VDC @ 7.6 amp, 12VDC @ 1.6 amp. 8 ft. blk. pow. cord. 11 1/2" W x 13 1/2" D x 3 3/4" H. Wt. 6 lbs. Part No. PS94VDS \$39.95 each

POWER SUPPLY 4-Channel Switching — Apple Compatible

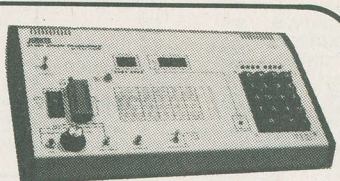
FOR USE AS AN EXTERNAL POWER SUPPLY FOR APPLE Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC 47-440Hz. Output: +5VDC @ 5A, +5VDC @ 1A, +12VDC @ 1A. Line reg.: ±0.2%. Ripple: 30mV p-p. Load reg.: ±1%. Overcurrent protection. Adj. 5V main output ±10%. 6-3/8" L x 1-7/8" W x 4-1/2" H. Wt. 1 1/2 lbs. Part No. FCS-604A \$69.95 each

\$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6 1/2% Sales Tax
Shipping Add 5% plus \$1.50 Insurance
Send S.A.S.E. for Monthly Sales Flyer!

Spec Sheets — 30¢ each
Send \$1.00 Postage for your
FREE 1984 JAMECO CATALOG
Prices Subject to Change



1355 SHOREWAY ROAD, BELMONT, CA 94002
11/83 PHONE ORDERS WELCOME — (415) 592-8097 Telex: 176043



JE664 EPROM PROGRAMMER

8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES

• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer Interface for editing/program/loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, — 10W power consumption • Enclosure: Color-coordinated, light tan panels w/ molded mocha brown end pieces • Size: 15-5/8" L x 8 1/4" W x 3 1/4" H • Wt. 5 1/2 lbs.

JE664-A EPROM Programmer \$995.00

Assembled & Tested (includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The JE665 RS232C Interface Option implements computer access to the JE664's RAM. Sample software written in BASIC provided for TRS-80® Model I, Level II Computer. Baud rate: 9600. Word length: 8 bits — odd parity. Stop bits: 2. Option may be adapted to other computers. The JE665 can be interfaced to any computer with an RS232 port. Information is also provided for interfacing to any CP/M system with an RS232 port.

JE664-ARS EPROM Programmer w/JE665 Option \$1195.00

Assembled & Tested (includes JM16A Module)

EPROM JUMPER MODULES

The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming pulses to the EPROM & configures EPROM socket connections for that particular EPROM.

PIN	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Motorola, National, Intel, TI (25V)	\$14.95
JM16A	2716, TMS2516	Intel, Motorola, National, NEC, TI, (25V)	\$14.95
JM16B	TMS2716	Motorola, TI (+5, -5, +12)	\$14.95
JM32A	TMS2532	Motorola, TI (25V)	\$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel (25V)	\$14.95
JM32C	2732A (21V)	Fujitsu, Intel (21V)	\$14.95
JM64A	MC680764	Motorola (21V)	\$14.95
JM64B	2764	Intel (21V)	\$14.95
JM64C	TMS2564	TI (25V)	\$14.95
JM64D	HN82764G-4	Hitachi (21V)	\$14.95

UV-EPROM Eraser

8 Chips — 51 Minutes

1 Chip — 37 Minutes

Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 51 minutes (1 chip in 37 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00" x 3.70" x 2.60". Complete with holding tray for 8 chips.

DE-4 UV-EPROM Eraser \$79.95

UVS-11EL Replacement Bulb \$16.95

IBM MEMORY EXPANSION KIT

SAVE HUNDREDS OF \$\$\$ BY UPGRADING MEMORY BOARDS YOURSELF!

Most of the popular memory boards allow you to add an additional 64K, 128K, or 256K. The IBM64K Kit will populate these boards in 64K byte increments. The kit is simple to install — just insert the nine 64K RAM chips in the provided sockets and set the two groups of switches. Directions are included.

IBM64K (Nine 200ns 64K RAMs) \$49.95

EXPAND YOUR MEMORY

TRS-80 to 16K, 32K, or 48K

**Model 1 = From 4K to 16K Requires (1) One Kit

Model 3 = From 4K to 48K Requires (3) Three Kits

Color = From 4K to 16K Requires (1) One Kit

**Model 1 equipped with Expansion Board up to 48K Two Kits Required — One Kit Required for each 16K of Expansion

TRS-16K3 *200ns for Color & Model III \$12.95

TRS-16K4 *250ns for Model I \$10.95

TRS-80 Color 32K or 64K Conversion Kit

Easy to install kit comes complete with 8 ea. 4164-2 (200ns) 64K dynamic RAMs & conversion documentation. Converts TRS-80 color computers with E circuit boards, & all new color computers to 32K. Minor modifications of 32K memory will allow the use of all the 64K of the dynamic RAM providing you have a FLEX DOS operating system.

TRS-64K2 \$44.95

5 1/4" Mini-Floppy Disk Drive

FOR TRS-80 Model I - COLOR COMPUTER

Features single or double density. Recording mode: FM single, MFM double density. Seek time: 25msec. Track to track. Power: +12VDC (±0.0V) 1.6A max. +5VDC (±0.25V) 0.8A max. Unit as pic. at right does not incl. case, power supply, cables. 30-day data book incl. Wt. 3 1/2 lbs. Size: 5 1/4" W x 8 1/2" D x 3 1/4" H.

Part No. Limited Quantity! Price

FD200 — 40 tracks, 250K bytes capacity \$179.95

FD250 — 40 tracks, 250K bytes capacity \$199.95

Double-sided, 35 tracks, 438K bytes capacity

8" FLOPPY DISK DRIVE

Shugart 801R compatible

Single-Sided

77 Tracks

400/800K Bytes Capacity

Industry Standard

The FDD100-8 8" Floppy Disk Drive (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single-sided soft sector IBM Diskette I, or eq. disk cartridge. Power: 115VAC @ 60-60Hz, +24VDC @ 1.7 amps max., +5VDC @ 1.2 amps max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.55" W x 14" L x 4.5" H. Weighs 12 lbs. incl. 96-pg. manual.

Part No. Price

FDD100-8 \$169.95 ea.

CPU'S & SUPPORT CHIPS			INTER FACE & DRIVERS		
8035	4.95	8251	4.50		
8039	6.95	8253	5.95		
8080A	2.75	8279-5	6.95		
8085A	5.75	8285	4.50		
AMD 2901	8.95	8287 (AM9517)	7.95		
8202	19.95	8289	5.95		
8212	1.80	280A CPU	4.75	1488	1.50
8214	3.50	280A SIO	12.95	1489	1.50
8216	1.75	280A PIO	10.95	8130	2.50
8224	2.25	280A CTC	8.95	8830	2.50
8226	1.80	280A CTCT	9.95	8833	2.50
8228	3.50	TMS 9927 NL	16.95	8837	2.00
8155	6.00	8275	12.95		
8156	8.95	6803L	13.95	MM5307	7.95
8237	14.00	6845	6.95	BR1941L	8.95
8238	3.95	6809	2.95	CRT5037	18.95
6748	19.95	6821	2.95	MM5369	2.50
8755	19.95	6850	4.50	TR1602B	3.95
8250	10.95	6875	39.50	PT1472	6.95
		68000L8		AY3-1015D.5	7.5
				AY5-1013A.3	7.5
				AY5-3600	9.95

SHIFT REGISTERS			DISC CONTROLLERS		
MM1402	1.75	1791	15.50		
MM1403	1.75	1793	35.00		
MM1404	1.75	1795	45.00		
MM5013	2.50	1797	45.00		
MM5055	2.50	D765C	16.95		
MM5056	2.50				
MM5057	2.50				
MM5060	2.50				

RAM's			NO. 30 WIRE WRAP WIRE SINGLE STRAND		
2708	3.50	2110A-4	1.50		
2716 + 5V	4.95	21102-3	7.0		
2732	7.95	2111A	1.95		
2732A-2	9.50	2114-2	1.40		
2532	7.95	2147-3	1.75		
2764	9.95	TMS3409	1.50		
MC86B764C	21.00	MM5406-11	2.5		
82523	1.95	MM5402	5.95		
(6331)	1.95	4108-3	1.50	2,000	6,144
825126	1.95	4116-12	1.95	3,579	10,000
825130	1.95	4118-4	5.50	4,000	18,000
3628A-3	3.00	5101E	2.95	5,000	18,432
MM5214C	2.95	25104-4	2.50	6,000	20,000
8255-5	1.25	6116-3	5.50		
74S387	1.75	4164-15	6.95		
74S474	3.95	3242	6.00		

DISC CAPACITORS			CRYSTALS		
1UF 16V	10/\$1.00	100/\$8.00			
01UF 35V	16/\$1.00	100/\$5.00			

PRINTED CIRCUIT BOARD			TOGGLE SWITCHES		
4" x 6" DOUBLE SIDED EPOXY BOARD 1/16" THICK	\$5.60 ea.		106D - SPDT - 1.00		
			206D - DPDT - 1.40		
			206P - DPDT - CENTER OFF 1.80		

FULL WAVE BRIDGE			SILICON POWER RECTIFIERS		
PRV	2A	6A 25A	PRV	1A	3A 12A 50A 125A 240A
100		1.40	100	.05	.14 .35 .90 5.00 6.00
200	.80	1.30 2.20	200	.05	.17 .50 1.30 7.00 9.00
400	1.00	1.65 3.30	400	.09	.25 .65 1.50 10.00 12.00
600	1.30	1.90 4.40	600	.11	.30 .80 2.00 13.00 15.00

REGULATORS			TANTALUM CAPACITORS		
LM338K	95.75	323K (LA1405)	22UF 35V	5/\$1.00	15UF 16V 3/\$1.00
LM317T	91.35	LM305G	47UF 35V	5/\$1.00	30UF 6V 5/\$1.00
78L05, 78L12	6.40	340T-5, 6, 8, 9, 12	68UF 35V	5/\$1.00	33UF 15V .50
723	5.50	15, 18 or 24V	1UF 20V	5/\$1.00	47UF 20V .85
320T, 5, 12, 15 or 24	8.95	LA5412 + 12V	2.2UF 20V	5/\$1.00	68UF 16V 1.00
LM337T	91.35	3A	3.3UF 20V	4/\$1.00	120UF 6V .75

FLAT RIBBON CABLE			DIP SWITCHES		
GRAY			CTS 206-4	4 POSITION	.75
28 gauge			CTS 206-7	7 POSITION	.95
			CTS 206-8	8 POSITION	.95
			CTS 206-10	10 POSITION	1.25

DIP SOCKETS			20KV-5A DIODES		
26 conductor	.60/ft		250 ma	1.95	
40 conductor	.90/ft				
50 conductor	1.00				

WIRE WRAP SOCKETS			20KV-5A DIODES		
14 PIN	—	.45	250 ma.	\$1.95	
16 PIN	—	.50			
18 PIN	—	.65			
20 PIN	—	.90	DB CONNECTORS		
24 PIN	—	1.10	DB9P - \$2.00	DB25P - \$2.40	
28 PIN	—	1.25	DB9S - 3.00	DB25S - 3.20	
			HOODS - 1.10	HOODS - 1.10	

POSTAGE RATES			TERMS: FOB CAMBRIDGE, MASS. SEND CHECK OR MONEY ORDER. MINIMUM TELEPHONE. C.O.D. PURCHASE ORDER OR CHARGE \$20.00. MINIMUM MAIL ORDER \$5.00.		
ADD 10% FOR ORDERS UNDER \$25.00					
ADD 5% FOR ORDERS BETWEEN \$25.00 & \$50.00					
ADD 3% FOR ORDERS ABOVE \$50.00					

SCR's			TRIAC's		
1.5A	6A	35A	PRV	1A	10A 25A
100	.35	.40 1.40	100	.35	.60 1.40
200	.40	.50 1.80	200	.50	.80 1.90
400	.60	.70 2.40	400	.70	1.00 2.60
600		1.00 3.60	600	1.00	1.20 3.60

C/MOS			EPOXY GLASS VECTOR BOARD		
4001	40	4028	.80	4077	.50
4002	40	4029	1.00	4081	.40
4006	80	4030	.80	4082	.40
4007	40	4034	1.75	4093	.80
4008	70	4035	1.00	4099	1.75
4009	50	4040	1.00	4601	.95
4010	60	4042	.80	4603	1.50
4011	45	4043	.90	4610	1.00
4012	45	4044	.80	4611	1.00
4013	60	4046	1.20	4614	1.25
4014	70	4047	1.50	4615	1.50
4015	80	4049	.80	4616	1.00
4016	80	4050	.80	4618	1.00
4017	100	4051	1.00	4620	1.20
4018	70	4052	1.00	4628	1.00
4019	70	4053	1.00	4638	1.25
4020	80	4060	1.00	4639	.80
4021	80	4066	.70	4685	.75
4022	100	4068	.60	74C00	.40
4023	40	4069	.60	74C02	.40
4024	70	4070	.50	74C04	.50
4025	40	4071	.60	74C08	.50
4026	.95	4072	.50	74C10	.40
4027	.80	4076	.65	74C14	.70

TTL IC SERIES			74LS SERIES		
7400	.24	7472	.40	74162	.60
7401	.24	7473	.45	74163	.60
7402	.24	7474	.50	74164	.60
7403	.24	7475	.50	74165	.60
7404	.24	7476	.45	74166	.70
7405	.24	7480	.45	74170	1.80
7406	.45	7483	.50	74173	.75
7407	.45	7485	.50	74174	.65
7408	.28	7486	.35	74175	.60
7409	.28	7489	1.90	74176	.75
7410	.24	7490	.35	74180	1.90
7411	.24	7491	.45	74182	.60
7412	.30	7492	.45	74190	.70
7413	.35	7493	.35	74191	.75
7414	.45	7494	.50	74193	.75
7415	.35	7495	.50	74194	.85
7416	.25	7496	.80	74195	.45
7417	.25	7498	.80	74196	.45
7420	.24	74107	.30	74198	.75
7425	.25	74116	1.50	74221	1.00
7426	.25	74121	.45	74273	.85
7427	.25	74122	.50	74279	.80
7430	.24	74123	.55	74286	.65
7432	.32	74128	.45	74365	.65
7437	.32	74145	.60	74367	.65
7438	.32	74148	1.10	74390	.90
7440	.24	74150	1.10	75325	1.50
7441	.75	74151	.50	75492	1.05
7442	.60	74153	.40	9601	.75
7445	.65	74154	1.10	9802	.75
7446	.65	74155	.50	8726	1.00
7448	.65	74157	.50	8728	1.25
7449	.65	74160	.85	8737	.90
7450	.24	74161	.65	8798	.90

MULTI TURN TRIM POTS			COAX CABLE		
50 OHM		5K			
100 OHM		10K			
500 OHM	3/\$2.00				
1000 OHM		500K			

SCR's			TRIAC's		
1.5A	6A	35A	PRV	1A	10A 25A
100	.35	.40 1.40	100	.35	.60 1.40
200	.40	.50 1.80	200	.50	.80 1.90
400	.60	.70 2.40	400	.70	1.00 2.60
600		1.00 3.60	600	1.00	1.20 3.60

C/MOS			EPOXY GLASS VECTOR BOARD		
4001	40	4028	.80	4077	.50
4002	40	4029	1.00	4081	.40
4006	80	4030	.80	4082	.40
4007	40	4034	1.75	4093	.80
4008	70	4035	1.00	4099	1.75
4009	50	4040	1.00	4601	.95
4010	60	4042	.80	4603	1.50
4011	45	4043	.90	4610	1.00
4012	45	4044	.80	4611	1.00
4013	60	4046	1.20	4614	1.25
4014	70	4047	1.50	4615	1.50
4015	80	4049	.80	4616	1.00
4016	80	4050	.80	4618	1.00
4017	100	4051	1.00	4620	1.20
4018	70	4052	1.00	4628	1.00
4019	70	4053	1.00	4638	1.25
4020	80	4060	1.00	4639	.80
4021	80	4066	.70	4685	.75
4022	100	4068	.60	74C00	.40
4023	40	4069	.60	74C02	.40
4024	70	4070	.50	74C04	.50
4025	40	4071	.60	74C08	.50
4026	.95	4072	.50	74C10	.40
4027	.80	4076	.65	74C14	.70

4012	.45	4044	.90	4511	1.00	74C86	.70	24
4013	.60	4046	1.20	4514	1.25	74C93	.70	24
4014	.70	4047	1.50	4515	1.50	74C154	2.50	24
4015	.60	4049	.60	4516	1.00	74C157	1.75	T
4016	.60	4050	.60	4518	1.00	74C180	1.20	T
4017	1.00	4051	1.00	4520	1.20	74C181	1.15	T
4018	.70	4052	1.00	4528	1.00	74C183	1.15	T
4019	.70	4053	1.00	4539	1.25	74C173	.75	T
4020	.80	4060	1.00	4583	.90	74C174	1.15	B
4021	.80	4066	.70	4685	.75	74C176	1.19	C
4022	1.00	4068	.50	74C00	.40	74C192	1.30	M
4023	.40	4069	.50	74C02	.40	74C901	.60	



FORMULA INTERNATIONAL INC.

12603 Crenshaw Blvd., Dept. B, Hawthorne, CA 90250

For information (213) 973-1921 • Orders Only (outside Calif.) (800) 672-8758



POCKET LIGHT

Complete with 5" fluorescent tube, powerful bulb and handy strap. Runs on 3 pcs 1.5V "C" size batteries (not included). It's a practical, convenient, powerful spotlight and fluorescent light. Its superior quality is ideal for indoor or outdoor use.

LOW PRICE \$6.50

SANYO UHF VARACTOR TUNER

FOR UHF CHANNELS 14-83

Tuning voltage +1 to +28VDC. Input impedance 75Ω. IF band width 7-16MHz. Size 2 1/4" x 1 1/4" x 3/4". Supply voltage 15VDC.

Model 115-B-403A, Video IF 45.0MHz
Model 115-B-405A, Video IF 62.5MHz

\$19.95

Tuner is the most important part of the circuit. Don't let those \$19.00 tuners fool you.

All units are brand new from Sanyo. When ordering please specify model number.



MARK IV — 15 STEP LED POWER LEVEL INDICATOR KIT

This new stereo indicator kit consists of 36 4-color LED's (15 per channel) to indicate the sound level output of your amplifier from -36dB to +3dB. Comes with a well designed silk screen printed plastic panel and has a selector switch to allow floating or gradual output indicating. Power supply is 6-12VDC with THG on board input sensitivity controls. This unit can work with any amplifier from 1W to 200W. Kit includes 70 pcs driver transistors, 38 pcs matched 4-color LED's, all electronic components, PC Board and front panel.

MARK IV KIT \$31.50



FLOURESCENT AUDIO LEVEL MONITOR

This is the kind of VU monitor that is being used by most amplifier manufacturers. IC's are used to simplify circuit layout. Easy to assemble and can be used with all power level amplifiers. Power requirement 12VDC.



TE-221 KIT
For Just \$28.50
(Limited Stock)

TA-1000
KIT
\$51.95

Power Transformer
\$24.00 ea.

100W CLASS A POWER AMP KIT

Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low TIM stereo pre-amp.

Specifications • Output power 100W RMS into 8Ω, 125W RMS into 4Ω • Frequency response 10Hz-100KHz • THD less than 0.01% • S/N ratio better than 80dB • Input sensitivity 1V max. • Power supply ±40V at 5A.

1 WATT AUDIO AMP

All parts are pre-assembled on a mini PC Board. Supply voltage 6-9VDC. **Special Price \$1.95**

6W AUDIO AMP KIT

TBA810 with Volume Control. Power Supply 6-18VDC **Only \$7.50 ea.**

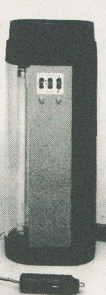
"FISHER" 30 WATT STEREO AMP

MAIN AMP (15W x 2). Kit includes 2 pcs. Fisher PA 301 Hybrid IC, all electronic parts with PC Board. Power supply ±16VDC (not included). Voltage gain 33dB, 20Hz-20KHz.

Super Buy Only \$18.50

SEND ONE DOLLAR FOR OUR DETAIL CATALOG

Inside California
Outside Calif. (incl. Mexico & Canada)
Overseas



LASER SUPER LATERN

Brilliant fluorescent lantern with 9" 6 watt fluorescent tube. Features include: Powerful direct beam spotlight with 9V pre-focus bulb; Buzzer horn - either constant or time intervals of sonic alarm; Twin blinker - red amber flashing or red & amber flashing on time intervals; Fully adjustable nylon strap. Operates from D size batteries or plugs into vehicle cigar lighter socket.

SPECIAL \$11.95

6-WAY A/C ADAPTOR

Input: 110VAC. Output: 3V, 4.5V, 6V, 7.5V and 12VDC. Current: 300mA.

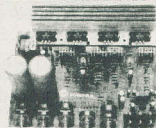
OUR LOW PRICE \$5.50 ea.

No FCC License Required
OUR PRICE \$49.50
Additional Microphone (Transmitter) Available at \$28.00 ea.
MURA WMS-49

CRYSTAL CONTROLLED WIRELESS MICROPHONE SYSTEM

Transmitter: FET mic for flat 30Hz-18KHz response. X'tal controlled 49MHz AM Band for drift-free performance. 100mW output (range approx. 1/4 mile) for reliable long range transmission. Powered by a 9V radio battery.

Receiver: X'tal controlled locks on 49MHz transmitter signal. On panel VU meter, monitors the signal strength from the microphone. Standard phone jack outlet connection to a P.A. or other phone input. 9V battery included. This professional set is ideal for on stage, in field, church, in house or outdoor use.



A GOOD BUY at \$65.00
TA-800

120W PURE DC POWER STEREO AMP KIT

Getting power hungry from your small amp? Here's a good solution! The TA-800 is a pure DC amplifier with a built-in pre-amp. All coupling capacitors are eliminated to give you a true reproduction of the music. On board tone and volume controls combined with built-in power supply make the TA-800 the most compact stereo amp available. Specifications: 60W x 2 into 8Ω. Freq Range: 0Hz-100KHz±3dB. THD: .01% or better. S/N Ratio: 80dB. Sensitivity: 3mV into 47K. Power Requirement: ±24-40 Volts.

WHISTLE ACTIVATED SWITCH BOARD

All boards are pre-assembled and tested. You whistle to its FET condenser microphone from a distance, as far as 30 feet away (sensitivity can be easily adjusted), and it will turn the switch on. If you whistle again it will turn off. Ideal for remote control toys, electrical appliance such as lights, coffee pots, TV, Hi-Fi, radio or other projects. Unit works on 9VDC.

Model 968\$2.50 ea.

LOW TIM DC STEREO PRE-AMP KIT TA-1020

Incorporates brand-new DC design that gives a frequency response from 0-100KHz ±0.5dB. Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuations!

Specifications: • THD/TIM less than .005% • Frequency response DC to 100KHz ±0.5dB • RIAA deviation ±0.2dB • S/N ratio better than 70dB • Sensitivity: Phone 2mV 47KΩ, Aux 100mV 100KΩ • Output level 1.3V • Max output 15V • Tone controls: Bass ±10dB @ 50Hz, Treble ±10dB @ 15Hz • Power supply ±24VDC @ 0.5A. Kit comes with regulated power supply. All you need is a 48VCT transformer @ 0.5A.

Only \$44.50
Transformer \$4.50 ea.



UNIVERSAL NI-CD BATTERY CHARGER MW-398

Charges 9V, AA, C or D size Ni-CD batteries all at one time.

Part No. 050-0190

\$11.50 ea.

SUPER FM WIRELESS MIC KIT

This new designed circuit uses high FREQ FET transistors with 2 stage pre-amp. Transmits FM range (88-120MHz) up to 2 blocks away and with the ultra sensitive condenser microphone that comes with the kit allows you to pick up any sound within 15 ft. away. Kit includes all electronic parts, OSC coils and PC Board. Power supply 9VDC.

FMC-105 \$11.50 per Kit

PROFESSIONAL FM WIRELESS MICROPHONE

Made by one of the leading Japanese manufacturers. This factory assembled FM wireless microphone is powered by two AA size batteries. It transmits in the range of 88-108MHz. Element is built in a plastic tube type case with an omni-directional electronic condenser microphone unit. By using a standard FM radio, signal can be heard anywhere on a one acre lot. Sound quality was judged "very good." MODEL WEM-36 was \$16.50.

ON SALE \$8.25 ea.

HEAVY DUTY 500mA MULTIPLE AC-DC ADAPTOR

For all battery operated electronic equipment up to 500mA with LED indicator.

Input: 117/220VAC, 50/60Hz

Output: 3, 4.5, 6, 7.5, 9 and 12VDC.

Model SA-8112A \$25.00 ea.

SANYO ANTENNA SIGNAL BOOSTER

This Booster is specially designed for UHF Channels (14-83). After installing (between the antenna input cable and the UHF tuner), this unit will provide a minimum of 10dB gain, that is approximately 2 times better than you are seeing now. Ideal for those who live in apartments that can not put up an outdoor antenna. Small in size, only 2" x 1 1/2" x 1". Supply voltage is 15 VDC.

Model 001-0076 \$12.50



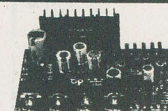
PROFESSIONAL REGULATED VARIABLE DC POWER SUPPLY KIT

All solid state circuitry with high efficiency power transistor 2SD388 and IC voltage regulator MC1733. Output voltage can be adjusted from 0-30V at 1A current limited or 0-15V at 2A current limited. Internal resistance is less than 0.005Ω, ripple and noise less than 1mV, dual on panel meters for voltage and current reading, also with on board LED and audible over load indicator. Kit comes with pre-drilled PC Board, instructions, all necessary electronic components, transformer and a professional looking metal cabinet. The best project for school and the most useful instrument for repairmen. Build one today!

Model TR88A 0-15VDC @ 2A

Model TR88B 0-30VDC @ 1A

\$59.50 per Kit



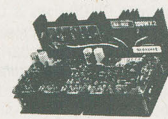
★ SPECIAL ★ Excellent Price!
Model 001-0034 \$29.50 per Kit
Transformer \$10.50 ea.

TA-322 30 WATTS TOTAL 15W + 15W STEREO AMP KIT

This is a solid state all transistor circuitry with on board stereo pre-amp for most microphone or phone input. Power output employs a heavy duty Power Hybrid IC. Four built on board controls for, volume, balance, treble and bass. Power supply requires 48VCT 2.5A transformer. THD of less than 0.1% between 100Hz-10KHz at full power (15 Watts + 15 Watts loaded into 8Ω).

LOW T.I.M. TRANSISTORS 100W + 100W

• Employs Hitachi low noise I.C. for pre-amp • Max. output 16 V P-P (non distortion) • With hi-low filter, and tone defeat circuit • Rear power amp with short circuit protection • Giant heat sink for maximum results • Tone controls ±14dB • All components (except pots for volume, and tone controls) are pre-assembled, the quality is guaranteed. • Power supply DC ±35V-50V



MODEL: SA802C

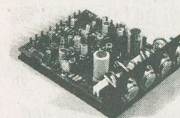
Part #370-0340 \$85.00

POWER TRANSFORMER (68V-80V CT 6 AMP)

Part #670-0220 \$24.50

60W + 60W O.T.L. AMP

Stereo pre-amp + tone control + power amp. All in on unit, fully assembled! Compact in size: 7"x4 1/2"x2 1/2". Can be fitted into most cabinets. Power transistors using 2SC1667 X 4 to give a max output of 60W + 60W (8Ω) • Frequency response: 20Hz-85KHz (-1dB) • Total harmonic distortion: 0.02% (1KHz) • Signal/Noise Ratio: 88 dB (open loop) • Tone control: 100 Hz ±16 dB 10 KHz ±14dB • Dynamic range: 60 dB • Power Supply: 48V-70V 5Amp. • Filter Capacitor: 4700µF 70V or better.



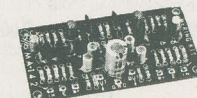
MODEL: SA-4520

Part #370-0350 \$39.95 ea.

1 Transformer Part #670-0230... \$22.50 ea.
2 Filter Capacitor 4700µF 70V \$6.50 ea.

MAGNETIC HEAD EQUALIZER

• Standard RIAA curve for all kinds of magnetic heads • 3 stages crossover circuit for best results • Output voltage guaranteed to be stable without any oscillation • Power Supply: 24 V.D.C.



MODEL: MA-142

Part #370-370 \$6.95 ea.

STEREO MIC. AND ECHO MIXER FOR STEREO AMPLIFIER SYSTEM

The circuitry employs all integrated circuits, BBD type echo circuit, echo time can be adjusted (max. .30 Msec.) Also with a microphone preamp on the board. Fully assembled.



MODEL: MX205

Part #370-0360 \$29.95 ea.

20 STEPS BAR/DOT AUDIO LEVEL DISPLAY KIT

This new designed audio level display unit is using a new integrated circuit from National Semiconductor to drive 20 pieces of color LEDs (green, yellow and red) on each channel. It provides two types of display methods for selection "bar" or "dot". The display range is from -57dB to 0dB. Kit is good for any amplifier from 2 watt to 200 watts! Power supply requires 12V AC or DC. So it is great for cars as well! Kit comes with printer circuit board, all LEDs, electronic components, switches, and silk screen printed professional front panel.



MODEL: TY-45

Part #370-0280 \$38.50

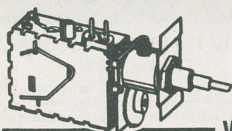
STORE HOURS
MON-FRI-10-7
SAT-10-6

Minimum Order \$10.00/Calif. Residents add 6.5% Sales Tax. Phone Orders Accepted on VISA or MC ONLY. NO C.O.D.'s. Prices subject to change without notice.

*Apple and Apple II are the trademark of APPLE COMPUTERS, INC.

CIRCLE 76 ON FREE INFORMATION CARD

MORE GAIN Than a Varactor UHF Tuner



\$15⁰⁰

SATISFACTION GUARANTEED
Frequency Range 470-899 MHz Channels
14-83. Output Channel 3. Ch 2 or 4 Avail.

PART #B20

WHAT'S IN IT?

\$15⁰⁰

To make a regular UHF tuner into a **GILCO HIGH GAIN TUNER**, each and every one of the following steps is painstakingly taken by a certified technician:

1. The first thing GILCO does is change the standard diode to a **hot carrier diode**.
2. The tuner's output is then measured on our JERROLD field strength meter and compared to a computer derived chart from which we determine the correct value coil to add across the IF output for **maximum pre-peaked gain**.
3. The tuner is then fed a standard 10db 300 ohm antenna input and while monitoring the output on our HEWLETT PACKARD spectrum analyzer, the tuner is tuned to the desired channel and its oscillator is offset for the desired output frequency as follows:

Channel 2: 58 Mhz, Channel 3: 63 Mhz, Channel 4: 68 Hhz

We call this step peaking because the tuner's output looks like a peak on our spectrum analyzer and the highest point of that peak is actually adjusted for the desired output.

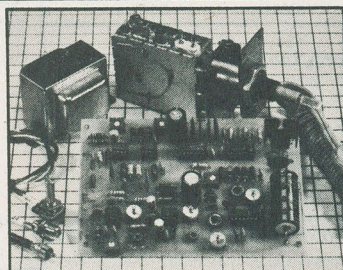
4. The last step is one more measurement on the field strength meter which is again compared to our performance chart to calculate the correct value of the second coil which is added to the tuners internal connections.

This procedure was developed by GILCO and it is our computer derived performance charts that make our tuner better, that's because **almost every tuner gets a different value coil** before it's peaked and again a different value coil after it's peaked. The combinations are endless and **the way we determine the values is our secret...**

GILCO PARTS KIT & PRINTED CIRCUIT BOARD

- Use with GILCO High Gain Tuner
- Requires NO Modification to Your Television
- Individually Packaged and Labeled Parts Save Guesswork

- The only tools required for assembly are: screwdriver, soldering iron, voltmeter. No drilling is required to the P/C board.
- This kit was designed to take advantage of the GILCO high gain tuner which means its circuitry is **simpler and more efficient** than those circuits that require inferior varactor tuners.



Pre-drilled, pre-screened, plated through the holes P/C board. All hardware, connectors, 22 page illustrated instruction manual, & Gilco Hy-Gain tuner. Kit assembles in just 4 hours.

FREE 22 Page Instruction Book included with each P/C Board or Parts Kit. This instruction book will guide the builder through every step of the assembly. **Nearly every page is illustrated.** With this Instruction Book, estimated assembly time is 4 hours.

HERE'S WHAT YOU GET FROM GILCO

Part No. B21 Printed Circuit Board

\$17⁰⁰

1. This Printed Circuit Board uses **only one** resistor. This prevents solder bridges.
2. The component layout is **screen printed** on the component side of the P/C board.
3. The solder side of the P/C board is covered with high temperature solder
4. **Newest Addition:** the P/C board is plated through the holes. This allows for easier and more positive soldered contact between the parts and the P/C board.

Part No. B22 Complete Electronic Parts Kit

\$80⁰⁰

All resistors (30), Potentiometers (1-5K, 3-10K), Panel Mount Potentiometer (10K), Electrolytic Capacitors (6), Ceramic and Mylar Disc Capacitors (35), Variable Capacitors (4), All Integrated Circuits (7), Voltage Regulator, Heat Sink, Diodes (4), IC Sockets (4-8 pin, 3-14 pin), Power Transformer (24V, 1A), Coil Kit with No. 26 wire (4), Speaker (4" 3oz.), Standoffs, Coaxial Cable, All Miscellaneous Hardware, Etc. All parts are individually packaged and labeled.

All components including the Wire, Hardware, Coaxial Cable and Heat Sinks are included in the parts kit. This means your assembly time from start to finish is just 4 hours.

GILCO ACCESSORIES & AMPLIFIER KITS

- #A02 New 2 stage, low noise, 28db gain, RF Amplifier Kit..... Kit \$18⁰⁰
- #A03 New 1 stage, low noise, 14db gain, RF Amplifier Kit..... Kit \$10⁵⁰

GILCO ORDER FORM

- #B20 GILCO Hy-Gain Modified Tuner \$15⁰⁰
- #B21 GILCO Pre drilled, Screen Printed, Circuit Board \$17⁰⁰
- #B22 GILCO Parts Kit (Less P/C Board) \$80⁰⁰
- #B20, B21, B22 Complete P/C Board and Parts Kit (all three) .. \$110⁰⁰
- #A02 Two stage, 28 db gain, Amplifier Kit \$18⁵⁰
- #A03 One stage, 14db gain, Amplifier Kit \$10⁵⁰

Name _____ Total _____
Address _____ Tax _____
City _____ State _____ Zip _____ Ship _____
Total _____

Mail Order Only. Send check or money order to:

GILCO INTERNATIONAL, INC.

P.O. Box 8817, Coral Gables, Florida 33124

CALL (305) 823-5891 for COD orders **PLEASE WRITE FOR OUR FREE CATALOG**
Shipping Orders under \$50 add 10%, Orders over \$50 add 5%, FL residents + 5% Tax

Another Fabulous Surplus Special

Complete, Off-Lease MICROCOMPUTER-BASED

Desk-Top

Word Processor Systems!!

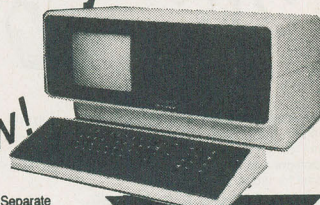
ONLY

\$895⁰⁰

shipping
ppd.

Limited Quantity
Available

Act Now!



Includes: 9V CRT Monitor, Dual Mini-Floppies, Separate Keyboard, Table Top Construction, Printer Interface, and more...
Fully tested and operational.

- Not obsolete: current product
- 8085 Micro architecture
- 48K of memory (4116's)
- Options available
- Printer interface port
- W.P. software available nationwide
- RS-232 other I/O's available
- Nationwide service available
- Complete Word Proc. Systems (Less Printer)

Untested Version of the Above

Less Keyboard. Includes Schematics, etc. LIMITED QUANTITY!

\$395.00

Parallel Input I/O TYPEWRITER/PRINTER

Refurbished, Tested, Operational

- Use as a Typewriter
- Use as a Computer Printer
- Excellent for Word Processing
- Takes Std. "Golf-Ball" Element

Call for More Info

Only 199.00

IBM Service Manual

\$24.00

"Selectric" is a Registered Trademark of IBM Corp.

Write Now or Call for Our Latest Bargain-Packaged Flyer

Computer
Products &
Peripherals
Unlimited

WAREHOUSE 18 Granite St. Haverhill, Mass. 01830
MAIL ORDERS Box 204 Newton New Hampshire 03838

617/372-8637

Sorry No Collect Calls
MasterCard & VISA Accepted

CIRCLE 68 ON FREE INFORMATION CARD

TECHNICIANS & SERVICEMEN

COMPONENTS FOR YOUR MAINTENANCE & REPAIR WORK

SPECIAL: OUR LOW LOW PRICES

REPLACEMENT FOR ECG® TYPES

TYPE NO.	YOUR COST	TYPE NO.	YOUR COST
85.....	FOUR for .99	125.....	SEVEN for .99
102A....	THREE for .99	159AP....	FOUR for .99
123A....	FIVE for .99	177.....	EIGHT for .99
123AP....	SIX for .99	199.....	FIVE for .99

SUPER SPECIAL (MIN. 5 PC. EACH)

TYPE NO.	YOUR COST	TYPE NO.	YOUR COST	TYPE NO.	YOUR COST
124.....	.85	165.....	2.25	375.....	.90
128.....	.45	171.....	.65	506.....	.55
129.....	.45	184.....	.45	500A....	8.95
130.....	.80	185.....	.45	523.....	9.95
152.....	.40	238.....	2.25	526A....	10.20
153.....	.40	276.....	6.95	529.....	13.75
154.....	.60	291.....	.95	712.....	1.25

JAPANESE TYPES (MIN. 5 PC. EACH)

2SC867A	2.75	HA1366W	1.85	STK0029	3.80
2SC1114	3.25	HA1377A	2.90	STK0080	9.99
2SC1308K	1.95	LA4102	1.25	TA7205AP	1.50
AN214Q	1.45	M51515BL	2.95	TA7208P	1.85
AN239A	4.60	STK433	3.95	TA7222AP	1.95
BA532...	1.80	STK435	3.95	UPC1181H	1.25
GH3F...	.89	STK437	6.25	UPC1182H	1.25
HA1342A	2.30	STK439	6.50	UPC1185H	2.99

COD ORDERS WELCOME (\$25 MIN. ORDER)

For Complete Component Catalog Call or Write

DIGITRON ELECTRONIC

110 HILLSIDE AVENUE, SPRINGFIELD, N.J. 07081

Toll Free: 800-526-4928 In NJ: 201-379-9016

*ECG IS A TRADE MARK OF PHILIPS ECG.

DIGITRON ELECTRONIC IS NOT ASSOCIATED IN ANY WAY WITH PHILIPS ECG.

CIRCLE 11 ON FREE INFORMATION CARD

WE HAVE QUALITY PARTS, DISCOUNT PRICES AND FAST SHIPPING!

TRANSFORMERS

120 volt primaries

5.6 VOLTS at 750 MA	\$3.00
6 VOLTS at 150 MA	\$1.25
16.5 V. at 3 AMPS	\$6.50
18 V at 650 MA	\$3.50
18 VOLTS at 1 AMP	\$4.50
18 V.C.T. at 2 AMP	\$5.50
24 VOLTS at 250 MA	\$2.50
24 VCT at 1 AMP	\$4.50
42 V.C.T. at 1.2 AMP	\$4.50

DC WALL TRANSFORMER

ALL ARE 115 VAC PLUG IN

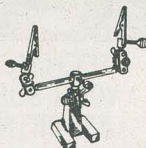
4 VDC at 70 MA	\$2.50
9 VDC at 225 MA	\$3.00
16.5 VAC at 10 VA	\$3.50
17 VAC at 500 MA	\$4.00

2K 10 TURN
MULTI-TURN POT
SPECTROL #MOD 534-7161
\$5.00 EACH

SOLID STATE RELAY
CONTROL: 3-32VDC
LOAD: 10 AMP
140 VAC
\$9.50 EACH

2 CHANNEL LIGHT ORGAN

EASILY HOOKS INTO STEREO SPEAKERS AND ALLOWS 110 VAC LIGHTS TO DANCE WITH MUSIC. TWO SEPARATE 110 VAC OUTPUTS FOR HIGH AND LOW FREQUENCY AUDIO SIGNALS. USE TWO ORGANS FOR STEREO!
\$6.50 PER UNIT
COLOR LIGHT STRING AVAILABLE \$1.75 EA



HELPING HAND

WILL HOLD P.C. BOARD OR OTHER SMALL ITEMS AND ALLOW BOTH YOUR HANDS FREEDOM TO WORK.
\$6.50 EACH

MULTI-SWITCHES

3 STATION NON-INTERLOCKING
3 - 2PDT SWITCHES. EACH OPERATES INDEPENDENTLY.
1 1/4" BETWEEN MOUNTING CENTERS.
\$1.75 EACH

5 STATION INTERLOCKING
MADE BY ALPS.
3 - 2PDT AND 2 - 6PDT SWITCHES ON FULLY INTERLOCKING ASSEMBLY.
3/4" BETWEEN MOUNTING CENTERS.
\$2.50 EACH

5 STATION NON-INTERLOCKING
SAME AS ABOVE, EXCEPT EACH SWITCH OPERATES INDEPENDENTLY.
\$2.50 EACH

MIKE CONNECTOR

5 CONDUCTOR IN-LINE PLUG AND CHASSIS MOUNT JACK. TWIST LOCK STYLE. SAME AS SWITCHCRAFT 12CL5M.
\$2.50 PER SET

CRYSTALS
CASE STYLE HC33/U

2 MHZ	COLORBURST 3579.545 KC
\$3.50 EACH	\$1.00 EACH

TRANSISTORS

2N706	5 for \$1.00
2N2222A	4 for \$1.00
PN2222	8 for \$1.00
2N2904	4 for \$1.00
2N2905	4 for \$1.00
2N2907	4 for \$1.00
MJ3030	\$2.50
2N3055	\$1.00
2N3585	\$1.00
2N3904	5 for \$1.00
2N3906	5 for \$1.00
2N4401	5 for \$1.00
2N4403	5 for \$1.00
2N4898	\$1.50
D43C8	2 for \$1.00
D44C2	.75
TIP 31	.75
TIP 32	.75
TIP 121	.75
TIP 126	.75

MICROWAVE TRANSISTOR
MRF 901 REDUCED TO N.P.N. SILICON \$2.00 EACH

LIGHTS

GRAIN OF WHEAT

T1 SIZE
.125" DIA. (3.15mm)

3 to 6 VOLTS	3 for \$1.00
Rated: 55ma @ 5 VOLTS	
6 to 12 VOLTS	3 for \$1.00
Rated: 55ma @ 8 VOLTS	
12 to 24 VOLTS	3 for \$1.00
Rated: 45ma @ 14 VOLTS	

T1 SIZE WITH WIRE LEADS

3 to 6 VOLTS	2 for \$1.00
Rated: 55ma @ 5 VOLTS	
6 to 12 VOLTS	2 for \$1.00
Rated: 55ma @ 8 VOLTS	
12 to 24 VOLTS	2 for \$1.00
Rated: 45ma @ 14 VOLTS	

T1 - 3/4 SIZE WITH WIRE LEADS

.163" DIA. (4.14mm)

3 to 6 VOLTS	2 for \$1.00
Rated: 45ma @ 6 VOLTS	
6 to 12 VOLTS	2 for \$1.00
Rated: 55ma @ 8 VOLTS	
12 to 24 VOLTS	2 for \$1.00
Rated: 45ma @ 14 VOLTS	

NEON W/ RESISTOR

DIRECT OPERATION FROM 120 VOLT
7 for \$1.00

120V INDICATOR

NEON INDICATOR. RATED 120 V 1/3 W. MOUNTS IN 5/16" HOLE. RED LENS.
75¢ EACH
10 FOR \$7.00
100 FOR \$65.00

SOLDERING IRON STAND

SPRING STEEL IRON HOLDER ON WEIGHTED BASE.
\$5.00 EACH

12 VOLT A.C. POWER UNIT

THIS UNIT CONSISTS OF A 12 VOLT 2 AMP TRANSFORMER, 1 AMP CIRCUIT BREAKER, 4 PRONG CINC HONES SOCKET AND A 3 WIRE A.C. CORD ALL MOUNTED IN AN ATTRACTIVE 4 1/2" x 5 1/2" x 3" CHASSIS BOX. GOOD FOR PARTS OR A NICE START FOR D.C. POWER SUPPLY.
\$8.50 PER UNIT

METERS

0 - 20 V.D.C.

0 - 20 VDC FULL SCALE FACEPLATE BATTERY TEST SET-UP AS INDICATOR
\$5.50 EACH

1 MA
2 5/16" SQUARE PANEL METER MOUNTS IN 2 1/8" HOLE
\$5.50 EACH

0 - 15 V.D.C.

THIS 2-1/4" SQUARE METER MEASURES 0-15 VDC.
\$4.50 EACH

METAL OXIDE VARISTOR

2 FOR \$1.50
G.E. # V82A12
50 VOLTS, NOMINAL D.C. VOLTAGE. 5/8" DIAMETER.

SWITCHES

MINI-PUSH BUTTON

S.P.S.T. MOMENTARY NORMALLY OPEN 1/4" BUSHING
35¢ EACH
10 FOR \$3.25
100 FOR \$30.00

SPECIFY COLOR: RED, BLACK, WHITE, GREEN, YELLOW.

KEY SWITCH

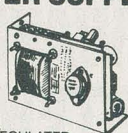
S.P.S.T. 4 AMPS @ 125 VAC. KEY REMOVES BOTH POSITIONS
\$3.50 EA

LIGHTED PUSH BUTTON

RED LIGHTED 120 VAC 10 AMP. S.P.S.T.
"POWER" PRINTED ON FACE. MOUNTS IN 7/8" SQUARE HOLE.
\$1.50 EA 10 FOR \$13.50

FREE! FREE! FREE! SEND FOR NEW LARGER! 48 PAGE CATALOG FREE! FREE! FREE!

POWER SUPPLY



REGULATED FULLY ADJUSTABLE 5 VDC AT 3 AMPS.
\$18.50 EACH

KEY ASSEMBLY

5 KEY
CONTAINS 5 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 3 3/4" LONG
\$1.00 EACH

6 KEY
CONTAINS 6 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 4 1/4" LONG.
\$1.25 EACH

POWER SUPPLY W/ PRE-AMP



THIS SUPPLY WAS USED TO POWER AN 8 TRACK/CASSETTE UNIT. IT WILL SUPPLY APPROX. 18 VDC AND INCLUDES A SMALL PRE-AMP TO BOOST SIGNAL LEVEL. RCA PLUGS FOR LINE IN/OUT.
\$4.50 EACH

LINE CORDS

TWO WIRE
6' 18ga TWO WIRE
3 FOR \$1.00

THREE WIRE
18 INCH 18ga THREE WIRE
2 for \$1.00

8 FOOT 18ga THREE WIRE
\$2.00 EACH

SLIDE POTS

100K linear tape
2" LONG
1 5/8" TRAVEL 75¢ EACH

500K linear taper
2 7/8" LONG
1 3/4" TRAVEL 75¢ EACH

DUAL 100K audio taper
3 1/2" LONG
2 1/2" TRAVEL. \$1.50 EACH

ROTARY SWITCH

1 POLE 6 POSITION
1 1/4" DIA x 1 1/2" HIGH
75¢ EACH 10 for \$6.00

RELAYS

MINIATURE 6 VDC RELAY

SUPER SMALL SPDT RELAY; GOLD COBALT CONTACTS.
RATED 1 AMP AT 30 VDC; HIGHLY SENSITIVE. TTL DIRECT DRIVE POSSIBLE. OPERATES FROM 4.3 TO 6 V. COIL RES. 220 OHM.
1 3/16" x 13/32" x 7/16" AROMAT # RSD-6V
\$1.50 EACH 10 FOR \$13.50

13 VDC RELAY

CONTACT: S.P.N.C. 10 AMP @ 120 VAC ENERGIZE COIL TO OPEN CONTACT...
COIL: 13 VDC 650 OHMS
SPECIAL PRICE \$1.00 EACH

4 PDT RELAY

14 pin style
3 amp contacts
24 volt d.c. coil
Used but fully tested
\$1.70 EACH
specify coil voltage
LARGE QUANTITIES AVAILABLE
SOCKETS FOR RELAY 50¢ each

COMPUTER GRADE CAPACITORS

1700 mfd. 150 VDC \$2.00
2 1/2" DIA x 4 3/4" HIGH
3,600 mfd.
40VDC \$1.00
1 3/8" DIA. x 3" HIGH
6,400 mfd.
60 VDC \$2.50
1 3/8" DIA. x 4 1/4" HIGH
22,000 mfd. 15 VDC \$2.00
2" DIA. x 2 1/2" HIGH
22,000 mfd. 40 VDC \$3.00
2" DIA. x 6" HIGH
24,000 mfd. 30 VDC \$3.50
1 3/4" DIA. x 4" HIGH
31,000 mfd. 15 VDC \$2.50
1 3/4" DIA. x 4" HIGH
72,000 mfd. 15 VDC \$3.50
2" DIA. x 4" HIGH
180,000 mfd. at 6V \$1.50
2 1/2" DIA. x 4 1/2" HIGH
CLAMPS TO FIT CAPACITORS 50¢ ea.

EDGE CONNECTORS

ALL ARE .156" SPACING

15 PIN GOLD
SOLDER EYELET \$1.75 EACH

15/30 GOLD
SOLDER EYELET \$2.00 EACH

18/36 GOLD
SOLDER EYELET \$2.00 EACH

22/44 TIN
P.C. STYLE; NO MOUNTING EARS.
\$1.50 EACH 10 FOR \$14.00

22/44 GOLD
P.C. STYLE \$2.00 EACH
10 FOR \$18.00

28/56 GOLD
P.C. STYLE \$2.50 EACH
10 FOR \$22.00

L.E.D.'S STANDARD JUMBO DIFFUSED

RED 10 FOR \$1.50
GREEN 10 FOR \$2.00
YELLOW 10 FOR \$2.00

FLASHER LED 5 VOLT OPERATION RED JUMBO SIZE
\$1.00 EACH

BI POLAR LED
200 FOR \$1.70

SUB MINI LED
.079" x .098"

RED 10 FOR \$1.00
200 FOR \$18.00
GREEN 10 FOR \$1.50

LED HOLDERS
TWO PIECE HOLDER FOR JUMBO LED
10 FOR 65¢ 200 FOR \$10.00

PHOTO-FLASH CAPACITORS

35 MFD 330 VOLT
1" x 5/8" DIA.
45¢ EACH...
10 FOR \$4.00

170 MFD 330 VOLT
1 1/8" x 7/8" DIA.
2 FOR \$1.50 10 FOR \$7.00

750 MFD 330 VOLT
2" HIGH x 1 1/4" DIA.
\$1.25 EACH 10 FOR \$11.00

TOLL FREE ORDERS ONLY
1-800-826-5432 (ORDER ONLY)
(IN CALIFORNIA: 1-800-258-6666)
ALASKA, HAWAII, OR INFORMATION
(213) 380-8000

ALL ELECTRONICS CORP.
ALL ELECTRONICS CORP.

905 S. Vermont Ave. P.O. BOX 20406 Los Angeles, Calif. 90006

CIRCLE 73 ON FREE INFORMATION CARD

TUSA

A WHOLE NEW WORLD OF TV VIEWING WITH TUSA'S NEW MODEL CVU-40, 40 CHANNEL CABLE TV CONVERTER. Receive all the EXTRA CABLE TV "MIDBAND" & "SUPERBAND" CHANNELS on your UHF DIAL.

Eliminates the need for renting or leasing. This system takes the "midband" and "superband" channels your TV, VCR or projector can't receive and converts them to standard UHF channels that any set can tune in.

A MUST FOR VIDEO-TAPING FROM CABLE TV!

The system allows you to program both pay (pay TV decoder required) and standard cable channels for taping on any VCR — while you are watching a different channel on your TV.

Simple to install and operate on any make of TV with UHF.

NOW AVAILABLE
NEW TUNEABLE DELUXE MODEL CVU-1000 **\$34.95 ea.**

WINEGARD
75 OHM UHF YAGI ANTENNAS

OPTIONAL: 12 db Gain **\$8.95 ea.**
 Preamp: 18db Gain **\$9.95 ea.**
 NF - 1.5db **\$6.95 ea.**

SPEAKER CABINET
 Popular speaker cabinets for those famous homebrew TV circuits. Speakers included.

Dimensions: 7 1/4" wide x 9 1/2" high x 5 1/2" deep. Removable 1/8" thick back cover.

SC001 **\$10.95 ea.**
 2 or more **\$8.95 ea.**

QUALITY POWER TRANSFORMERS
 24V CT, 400 mA.

\$3.19 ea. 10-49 **\$2.75 ea.**
 50 or more **\$2.25 ea.**

SONY SURPLUS UHF-VHF VARACTOR TUNERS

These tuners receive all channels 2-83, plus midband cable channels and are perfect for homebrew TV circuits etc. Output Freq. 45 MHz. Hookup data included. Name Brand.

#852 **NOW! \$15.95 ea.**

UHF TUNERS

Click Stop Defect Tune model. Excellent for replacement use or experimental work building UHF receivers for ham or TV.

WHILE THEY LAST
\$3.95 ea.
 10 or more **\$3.25 ea.**

AC LINE CORDS

18 gauge wire
 6 ft. long cable
 Prestripped and tinned ends for easy installation.

AC-6G 12-Up **49c ea.**
 39c ea.

POPULAR IC'S

TOP QUALITY NO SECONDS

TYPE	DESCRIPTION	1-9	10-UP
LM-380N	2 watt Audio Power Amp	\$1.49	\$.89
LM-386N-3	Low Voltage Audio Amp	1.59	1.19
LM-565N	Phase Locked Loop	1.49	.99
LM-733N	Video Amp	1.99	.98
MC-1350	Video Detector	2.29	1.69
MC-1349	Video IF Amp	2.06	1.55
MC-1350	Video IF Amp	1.75	1.19
MC-1352	Video IF Amp AGC	2.69	2.09
MC-1356	Audio IF Amp	1.86	1.64
MC-1374P	R.F. Modulator	3.19	2.39
MC-1458	Dual Comp. Op Amp	.88	.59
MC-1496N	Balanced Mod/Demodulator	1.19	.84
LM-1889	Video Modulator	2.79	1.95
LM-7805	5 Volt Positive Volt. Reg.	1.19	.89
LM-7808	8 Volt Positive Volt. Reg.	1.19	.89
LM-7812	12 Volt Positive Volt. Reg.	1.19	.89
LM-7815	15 Volt Positive Volt. Reg.	1.19	.89
LM-7818	18 Volt Positive Volt. Reg.	1.19	.89
LM-7824	24 Volt Positive Volt. Reg.	1.19	.89

NE-564 New Plug-in Replacement now in stock. \$5.75 ea. or \$3.50 each with every \$50.00 purchase of other parts.

UNITECH MODEL DUPIT TELEPHONE

This handsome contemporary telephone is Touch-tone, making it ideal for MCI or Sprint service, or banking by phone. Deluxe two piece design allows for wall or desk mount. Also on-off finger switch. Almond in color.

NOW \$29.95 ea.

PROJECT BOXES

Woodgrain

This box is 11 1/4" W - 4 1/2" H - 6 1/2" D with a removable aluminum U-shaped chassis 11" W - 3 1/2" H - 6" D inside.

\$12.50 ea.
 4 or more **\$10.95 ea.**
 For Larger Quantities - CALL

75 OHM CHASSIS MOUNT CONNECTOR

F-61 Female connector. Rear chassis mount with nut. Mates with male "F" connectors.

NOW! 4 for \$1.00

POPULAR MISCELLANEOUS PARTS

IN4001 Diodes
 15 for \$1.00
 10 for \$.50
 1/4w 10K Thermistors
 1-1239
 13-Up29
 Toroids - T30-1246
 20-Up25
 Toroids - T37-238
 20-Up25

DELUXE A-B SWITCHES

Specify Pushbutton or lever type

For CATV - MATV - VCR
 75 ohm - 90 db Isolation

\$6.95 ea.
 2 or more **\$5.95 ea.**

NEW 1984 B&K AUTO/MANUAL RANGING MULTIMETER

MODEL 2807

SPECIAL PRICE! \$94.00 ea.

5% MICA CAPS 5%

10pf .42c ea. 560pf .66c ea.
 43pf .36c ea. 1200pf .89c ea.
 110pf .38c ea. 3000pf 1.39c ea.

Call for Quantity Discount

POPULAR MICROWAVE PARTS

MRF-901 \$2.39
 9-Up 1.95
 MRF-911 1.95
 9-Up 1.52
 MBD-10158
 CHIP CAPS -.001 mfd30
 26-Up30
 2N6603 (formerly MRF-902) 11.96

Call for Quantity Discount

Now Back in Stock! MITSUBI UHF VARACTOR TUNERS

75 Ohm Input - 45 MHz Output
 For Channels 14 - 83

NEW LOW PRICE \$16.95 ea.
 All units are brand new.
 Call for Quantity Price

DELUXE A-B SWITCHES

Specify Pushbutton or lever type

For CATV - MATV - VCR
 75 ohm - 90 db Isolation

\$6.95 ea.
 2 or more **\$5.95 ea.**

ORDER NOW TOLL FREE 800-854-4655
 OUTSIDE CALIFORNIA
714-635-5090
 INSIDE CALIFORNIA

R.F. ELECTRONICS
 1056 N. STATE COLLEGE BLVD., DEPT. R
 ANAHEIM, CALIFORNIA 92806

OPEN TUES - FRI 10 - 6
 SAT 10 - 5
 CLOSED SUN & MON

SEND FOR FREE Mail Order Catalog

PERSONAL CHECKS HELD FOR CLEARANCE — NO MINIMUM ORDER
 ALL PREPAID ORDERS 2 LBS OR LESS MUST INCLUDE \$2.50 SHIPPING & HANDLING — SHIPPED SAME DAY RECEIVED

TEK-EL

TECHNICAL ELECTRONICS

YOUR SUPPLY SOURCE WITH ASSORTMENTS LIKE THESE:

LED ASSORTMENT

25 LEDs at a price everyone can afford! Red, Green, Yellow, Amber in all shapes and sizes.

Stock No. 10-1501 **\$2.95 pkg.**

SWITCH ASSORTMENT

8 general purpose toggle switches. Includes single, double, and three pole switches from top manufacturers such as Cutler-Hammer and others!

Stock No. 12-2230 **\$6.95 pkg.**

FOOT ASSORTMENT

Plastic, rubber, snap-fit, felt bottom, stud mount, you name it—it's in this assortment of approx. 100 feet.

Stock No. 49-2398 **\$2.95 pkg.**

SLIDE SWITCH ASSORTMENT

Includes SPDT and DPDT slides. 10 pieces per package.

Stock No. 12-1400 **\$1.50 pkg.**

ODDS-N-ENDS BARGAIN BOX

5 pound Random assortment of good quality components and parts. Includes items such as capacitors, diodes, motors, transformers, printed circuit boards, and much more!

Stock No. 49-3041 **\$10.00 pkg.**

TERMINAL STRIP ASSORTMENT

Half pound of approx. 100 pieces. Random assortment of sizes and lengths.

Stock No. 49-2400 **\$2.95 pkg.**

ORDER TODAY! VISA, MASTERCARD & COD accepted for phone orders. Please add \$3.00 for UPS ground. Satisfaction guaranteed. Call or write for your FREE CATALOG!

TECHNICAL ELECTRONICS

Dept. M P.O. Box 2361
 Woburn, MA 01888 (617) 935-1717

Touch Tone Generator Mini-Kit

K-1263

\$5.95
 10 @ \$5.35

MK5089N & 3.579 MHz CRYSTAL USE WITH ANY 4 X 3 SWITCH MATRIX
 10 PAGE DATA BOOK \$5

C126 D

400 V
 12 AMP
 SCR
 TO 220 CASE
99c
 10/9

POWER TRANSFORMER

PRI 115/230 VAC
 SEC1 28VCT AT 5 AMPS
 SEC2 15VCT AT 2 AMPS

3-3/4 X 3-1/4 X 3-1/8 HIGH

\$1.95

GREAT TRANSFORMER FOR 5 & 12V REGULATED SUPPLIES—THIS IS A COOL RUNNING UNIT. INDIVIDUALLY QUALITY UNIT. INDIVIDUALLY BOXED. T-0880 WT 6 LB

POWER SUPPLY

12-15 VOLT 1.6 AMP
 COMMERCIAL POWER SUPPLY. STANDARD POWER TYPE SPS 30-15. BRAND NEW, INDIVIDUALLY BOXED. 115V/230V INPUT

VOLTAGE REGULATED, CURRENT LIMIT

SPECIAL \$15
 X-3015 3 LB

8/16 TRACK TAPE HEADS

INSTRUMENTATION MFR PAID OVER \$1,000 PER HEAD. WITH A RESPONSE > 50,000HZ AT 7-1/2 IPS, THESE HONEYWELL PERFORM! 8 TRKS ON 1" TAPE, 2 HEADS CAN BE STAGGERED TO GET 16 TRKS. NEW, UNUSED R-8 B TRK RECORD OR P-8 B TRK PLAY \$35 ea.

THIS BATCH IS NEW. REMOVED FROM EQUIP (A LIL' BIN RASH, NOT SERIOUS) YOUR CHOICE **\$15**

E-1/2 1/2" ERASE
 PP-8 1" PLAY 8 TRK
 PP-8 1" RECORD 8 TRK
 PP-14 1" PLAY 14 TRK
 PP-28 2" PLAY 28 TRK

Channel 2 Decoder

NOT BEAL ON SOPHISTICATED DE-SCRAMBLERS REMOVED FROM SERVICE, REFURBISHED, & THEN PLACED IN RESERVE UNTIL WE GRABBED 'EM! POWERED BY 117 VAC, UNIT HAS TWO CONNECTIONS 'IN' AND 'OUT'. TWO SWITCHES 'STANDARD' AND 'PREMIUM' AND AN AC OUTLET FOR YOUR TV. FEATURES A DOUBLE BALANCED MIXER FOR STRIPPING 'INTERFERENCE'. A ALL FOR SYNC RE-INSERTION. LOTS OF NICE CIRCUITRY FOR EXPERIMENTATION! OVERALL SIZE IS 10 X 6-1/2 X 3" HIGH. MFD BY JEROLD

\$15.95
 10 @ \$14.35

DIGITAL COFFEE TIMER

CLOCK Assy. U-FIX-EM

X-1500 **10/25**
 WT 1/2 LB **\$2.95**

HERE'S THE GUTS FROM THOSE NEW COFFEE MAKERS WITH A COMPUTER 'BRAIN' THAT DIGITALLY CONTROLS THE COFFEE MAKING. A PERFECT EXAMPLE OF MONDAY MORNING BLAHS - 9 OUT OF 10 HAVE SOLDER SHORTS, CUT FOLDS, ETC. - EASY TO REPAIR STUFF. THE PCB'S CONTAIN A CLOCK/TIMER MODULE, 4 DIGIT LED DISPLAY, POWER XFMR, 9V SPOT RELAY, ETC. THE XFMR OR RELAY ALONE IS WORTH IT!

ELECTRONIC BARGAINS

IF YOU'RE NOT ON OUR MAILING LIST, YOU'RE MISSING OUT—STANDING BUYS ON THE FINEST IN ELECTRONIC PARTS FOR THE BUILDER. IN 8 YEARS OVER 250,000 HOBBYISTS HAVE DISCOVERED WHERE TO FIND USEFUL, UNIQUE OR DOWNRIGHT STRANGE ELECTRONICS AT GIVEAWAY PRICES. WHY NOT SEND FOR OUR CATALOG TODAY — IT'S FREE!!

DIAMONDBACK

ELECTRONICS COMPANY

PO BOX 12095 Dept 102
 SARASOTA, FLA. 33578

Phone Orders (813) 953-2829

CONTINENTAL US ADD \$1.60 FOR THE FIRST LB AND 50¢ FOR EACH ADDITIONAL LB
 WEST COAST ADD \$1.80 FOR THE FIRST POUND & 50¢ FOR EACH ADDITIONAL POUND
 COD & MAIL ORDER \$7 MINIMUM. CREDIT CARDS \$15 MIN.

CABLE TV

Midband Converter

BRAND NEW PRODUCTION AEL UNIT TAKES THE 'HIDDEN CHANNELS' ON MIDBAND AND MOVES THEM TO CHANNELS 7-13. SWITCH SELECTS 'NORMAL' OR 'MIDBAND'. JUST PUT IN LINE WITH YOUR CABLE AND SWITCH BACK & FORTH. 115 VAC WITH OUTLET FOR YOUR TV. ONLY TWO CONNECTIONS IN & OUT. OVERALL SIZE IS 6 X 4-5/8 X 2" HIGH

\$15.95
 10 @ \$14.35

CABLE TV

Converter / Descrambler

THESE AEL CONVERTERS ACCEPT ANY TWO NON-ADJACENT MIDBAND CHANNELS, DE-SCRAMBLE THEM AND OUTPUT THEM TO CHANNELS 2, 3, OR 4 (SET TO 3 AS RECEIVED). INPUT IS 126-168 MHz OR 216-264 MHz. INSERTION LOSS 1.6 DB MAX. INPUT LEVEL -15 TO +25 DBMV. FOR USE ON 75 OHM CABLE SYSTEMS. WE PROVIDE SCHEMATICS AND OPERATION NOTES. QUANTITIES LIMITED. WE SAW THESE LISTED AT \$125.00!

\$24.95
 X-1290 WT 5 LB
 10 @ \$22.45

CIRCLE 27 ON FREE INFORMATION CARD

HIGH QUALITY UP TO 55dB GAIN

MICROWAVE TV SYSTEM

Variable from 1.9 to 2.5 GHz

The latest advance in microwave technology with a SNOW-FREE PICTURE.

Introductory SPECIAL

\$124.95

Includes Shipping & Handling

THIS UNIT COMES COMPLETE WITH:

- 20" Fiberglass Parabolic Dish
- Pre-Assembled Probe with Down Converter
- Power Supply and Coax Switch
- 60' of RG-59/U Coax with Connector
- Transformer for 75 to 300 Ohms
- All Mounting Hardware for Fast and Easy Installation

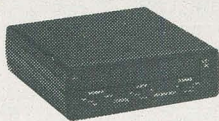
Send Cashiers Check or Money Order to: (Personal Checks, allow 2-5 weeks to clear)

PROFESSIONAL VIDEO, Inc.
 4670 Hollywood Blvd., Hollywood, Calif. 90027
219-0227
 For C.O.D. Orders Call (213) **352-9681**

CIRCLE 30 ON FREE INFORMATION CARD

ramsey

the first name in Counters!



9 DIGITS 600 MHz \$129⁹⁵ WIRED

PRICES:
CT-90 wired, 1 year warranty \$129.95
CT-90 Kit, 90 day parts warranty 109.95
AC-1 AC adaptor 3.95
BP-1 Nicad pack + AC Adapter/Charger 12.95
OV-1, Micro-power Oven time base 49.95
External time base input 14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:
Range: 20 Hz to 600 MHz
Sensitivity: Less than 10 MV to 150 MHz
Less than 50 MV to 500 MHz
Resolution: 0.1 Hz (10 MHz range)
1.0 Hz (60 MHz range)
10.0 Hz (600 MHz range)
Display: 9 digits 0.4" LED
Time base: Standard-10,000 mHz, 1.0 ppm 20-40°C.
Optional Micro-power oven-0.1 ppm 20-40°C
Power: 8-15 VAC @ 250 ma

7 DIGITS 525 MHz \$99⁹⁵ WIRED

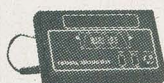
SPECIFICATIONS:

Range: 20 Hz to 525 MHz
Sensitivity: Less than 50 MV to 150 MHz
Less than 150 MV to 500 MHz
Resolution: 1.0 Hz (5 MHz range)
10.0 Hz (50 MHz range)
100.0 Hz (500 MHz range)
Display: 7 digits 0.4" LED
Time base: 1.0 ppm TCXO 20-40°C
Power: 12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty \$99.95
CT-70 Kit, 90 day parts warranty 84.95
AC-1 AC adaptor 3.95
BP-1 Nicad pack + AC adapter/charger 12.95



7 DIGITS 500 MHz \$79⁹⁵ WIRED

PRICES:

MINI-100 wired, 1 year warranty \$79.95
AC-Z AC adaptor for MINI-100 3.95
BP-Z Nicad pack and AC adapter/charger 12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range: 1 MHz to 500 MHz
Sensitivity: Less than 25 MV
Resolution: 100 Hz (slow gate)
1.0 KHz (fast gate)
Display: 7 digits, 0.4" LED
Time base: 2.0 ppm 20-40°C
Power: 5 VDC @ 200 ma

8 DIGITS 600 MHz \$159⁹⁵ WIRED

NEW
READ
RECEIVER
FREQUENCY

SPECIFICATIONS:

Range: 20 Hz to 600 MHz
Sensitivity: Less than 25 mv to 150 MHz
Less than 150 mv to 600 MHz
Resolution: 1.0 Hz (60 MHz range)
10.0 Hz (600 MHz range)
8 digits 0.4" LED
Time base: 2.0 ppm 20-40°C
Power: 110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty \$159.95
CT-50 Kit, 90 day parts warranty 119.95
RA-1, receiver adapter kit 14.95
RA-1 wired and pre-programmed (send copy of receiver schematic) 29.95



DIGITAL MULTIMETER \$99⁹⁵ WIRED

PRICES:

DM-700 wired, 1 year warranty \$99.95
DM-700 Kit, 90 day parts warranty 79.95
AC-1, AC adaptor 3.95
BP-3, Nicad pack + AC adapter/charger 19.95
MP-1, Probe kit 2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts: 100uV to 1 KV, 5 ranges
DC/AC current: 0.1uA to 2.0 Amps, 5 ranges
Resistance: 0.1 ohms to 20 Megohms, 6 ranges
Input impedance: 10 Megohms, DC/AC volts
Accuracy: 0.1% basic DC volts
Power: 4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug..... \$ 7.95
High impedance probe, light loading..... 15.95
Low pass probe, for audio measurements..... 15.95
Direct probe, general purpose usage..... 12.95
Tilt bail, for CT 70, 90, MINI-100..... 3.95
Color burst calibration unit, calibrates counter against color TV signal..... 14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

ramsey electronics, inc.

2575 BAIRD RD. • PENFIELD, NY 14526



PHONE ORDERS
CALL 716-586-3950

TERMS

Satisfaction guaranteed - examine for 10 days, if not pleased, return in original form for refund. Add 5% for shipping - insurance to a maximum of \$10. Overseas add 15%. COD add \$2. Orders under \$10, add \$1.50. NY residents, add 7% tax.

CIRCLE 79 ON FREE INFORMATION CARD

NOVEMBER 1983

It's like no other magazine in the world!

Between the covers of this special annual publication are carefully selected articles on scientific developments, recent technical advances, consumer products trends, development of services, exotic communications advances, design information, hobbying tips, and "what's new" material compiled for your reading pleasure and information. Each article was specifically chosen and prepared for publication by the editorial staff of *Radio-Electronics* magazine, updated to the moment it went on press and printed. Here's what you will read about in the 1984 edition:

VIDEO ENTERTAINMENT—It couldn't be said all in one article so we compiled a 16-page special section covering the changing and growing field of entertainment in the home: new video components with screens from the gigantic to the tiny postage-stamp size, accessories that didn't exist last year, and tips on getting the most from what you own or plan to buy.

SATELLITE TV—The countryside is strewn with parabolic tracking dishes installed by home owners to pull-in the countless television channels transmitted back to earth by satellites poised in space in geosynchronous orbits. You, too, can enjoy the programming selection—and much of it is commercial-free, too!

MOBILE TELEPHONES—What was once a status symbol for the idle rich is quickly becoming a working

tool for the common man. Cellular technology promises more channels with a little help from applied computer technology.

DIGITAL AUDIO DISCS—Laser rays are bringing new noise-free, pulse-encoded audio programming to your stereo system embedded in a plastic disc immune to strawberry jam, sandpaper, and desert heat.

MAIL ORDER BUYING—You've heard the bad points, including the myths. Now, here are the facts and economics of buying mail order that will be an asset to your business or hobby.

PLUS—There's so much more, we have space only to mention an electronic guitar tuning project, theory on digital filters, how to make inexpensive computer cables, build a programmable home thermostat, tips on buying pocket-size shortwave receivers, stereo audio for TV, all about VLF active antennas, news on pagers, how to restore antique radios, and....



Radio-Electronics ANNUAL 1984

How to Order—

We can't drop your copy of **Radio-Electronics Annual 1984** into the mail sack until we receive an order from you! So, do it today! Fill out the coupon below, giving us all the information requested, write a check or money order (no stamps) for the correct amount, and mail at once to:

RADIO-ELECTRONICS ANNUAL
Circulation Department
200 Park Avenue South
New York, NY 10003.

☐ Okay, drop my copy of **Radio-Electronics Annual 1984** into the mail bag. I am enclosing \$2.50 for the issue plus \$1.00 for postage and handling for US, Canada and Mexico. All other countries add \$2.00. US funds only.

☐ I can use _____ copies of **Radio-Electronics Annual 1984**. I am enclosing \$2.50 for each copy plus \$1.00 for postage and handling for US, Canada, and Mexico. All other countries add \$2.00. US funds only.

SEND CHECKS OR MONEY ORDERS ONLY

Allow 6-8 weeks for delivery.

RE1183

☐ I know you have a limited supply of the **1983 Edition** of the **Radio-Electronics Annual**. Please send me _____ copies. I am enclosing \$2.50 for each copy plus \$1.00 for postage and handling for US, Canada, and Mexico. All other countries add \$2.00. US funds only.

Please Print

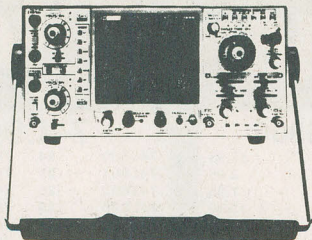
Name _____

Street Address _____

City _____

State _____

ZIP _____



OSCILLOSCOPES

BK PRECISION DYNASCAN CORPORATION

MODEL		Reg. PRICE	OUR PRICE
1405	5 MHz	\$ 315.00	\$ 268.00
1466A	10 MHz	475.00	399.95
1476A	DUAL TRACE 5" 10 MHz	545.00	449.95
1477	15 MHz	595.00	499.95
1479B	30 MHz	795.00	619.95
1522	20 MHz	695.00	590.75
1540	40 MHz	950.00	809.95
1560	60 MHz	1150.00	979.95
1570	70 MHz	1395.00	1095.00
1590	100 MHz	1995.00	1695.00

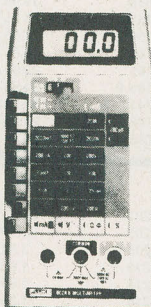
HITACHI
Hitachi Denshi, Ltd.

MODEL		Reg. PRICE	OUR PRICE
V-222	20 MHz	\$ 695.00	\$ 590.75
V-422	40 MHz	895.00	760.75
V-650	80 MHz	1195.00	995.00
V-1050	100 MHz	1995.00	1690.00
V-209	20 MHz PORTABLE	950.00	790.95

DIGITAL MULTIMETERS

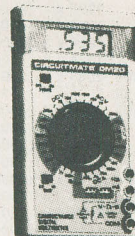
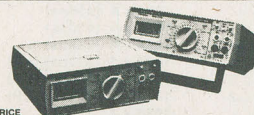
FLUKE

MODEL		OUR PRICE
8020B	ANALYST DIGITAL MULTIMETER	\$194.00
8021B	TROUBLESHOOTER DIGITAL MULTIMETER	159.00
8022B	TROUBLESHOOTER DIGITAL MULTIMETER	144.00
8024B	INVESTIGATOR DIGITAL MULTIMETER	249.00
8026B	3 1/2 DIGIT MULTIMETER	219.00
8060A	4 1/2 DIGIT HANDHELD METER	349.00
8062B	4 1/2 DIGIT HANDHELD METER	279.00
8010A	3 1/2 DIGIT MULTIMETER BENCH OR FIELD	259.00
8012A	3 1/2 DIGIT MULTIMETER BENCH OR FIELD	339.00
8012A-01	3 1/2 DIGIT MULTIMETER BENCH OR FIELD	379.00
8050A	4 1/2 DIGIT MULTIMETER BENCH OR FIELD	389.00
8050A-01	3 1/2 DIGIT MULTIMETER BENCH OR FIELD	439.00



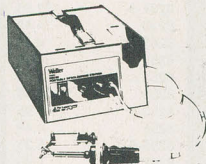
BECKMAN

MODEL		OUR PRICE
TECH 300	3 1/2 DIGIT MULTIMETER	\$120.00
TECH 310	3 1/2 DIGIT MULTIMETER	140.00
TECH 310UL	3 1/2 DIGIT MULTIMETER	150.00
TECH 320B	3 1/2 DIGIT MULTIMETER	170.00
TECH 330	3 1/2 DIGIT MULTIMETER	209.00
HD-100	PORTABLE DIGITAL MULTIMETER	169.00
HD-110	PORTABLE DIGITAL MULTIMETER	180.00
CIRCUITMATES		
DM-15	3 1/2 DIGIT MULTIMETER	\$59.95
DM-20	3 1/2 DIGIT MULTIMETER	64.95
DM-25	3 1/2 DIGIT MULTIMETER	79.95
DM-40	3 1/2 DIGIT MULTIMETER	69.95
DM-45	3 1/2 DIGIT MULTIMETER	89.95



Weller

MODEL		OUR PRICE
WTCPN	SOLDERING STATION	\$ 69.95
EC-1000	SOLDERING STATION	105.00
EC-2000	SOLDERING STATION	144.95
DS-600	PORTABLE DESOLDERING STATION	325.00
DS-500	DESOLDERING STATION	399.95
DS-100	DESOLDERING STATION	69.95



ungar

MODEL		OUR PRICE
9270	SOLDERING STATION	\$ 79.95
9100	SOLDERING STATION	96.00
9000	SOLDERING STATION	135.00
HOT VAC 2000	DESOLDERING STATION	325.00
HOT VAC 4000	DESOLDERING STATION	349.95

DIGITAL and ANALOG
INSTRUMENTATION
Simpson

MODEL		OUR PRICE
260-7	VOM	\$104.95
260-6XL	VOM EXTRA FEATURES	120.00
360-2	PORTABLE DIGITAL VOM	319.95
360-3	PORTABLE DIGITAL VOM	234.95
461-2	AVERAGE SENSING DMM	175.00
462	AUTORANGING DMM	219.95
463	DMM	175.00
470	HANDHELD DMM	124.95
467E	TRUE RMS DMM	191.25
467	"DIGALOG" DMM	229.50
380	MICROWAVE LEAK TESTER	325.00



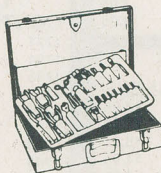
CABLE CONVERTERS THESE ARE NOT DESCRAMBLERS

MODEL		OUR PRICE
JERROLD LCC-58	60 CHANNEL CORDLESS TV CONVERTER	\$110.00
LCC-91	91 CHANNEL CORDLESS TV CONVERTER	119.95
TECHNIKA 8301	WIRELESS REMOTE CONTROL TV TUNER	110.00
BP 5746	46 CHANNEL / UHF CONVERTER FOR TV AND VTR	29.95



Xcelite

MODEL	REG.	OUR PRICE
TC-100/ST	\$499.95	\$349.95
TC-150/ST	379.95	289.95
TC-200/ST	236.17	179.95



NAME BRAND TRANSISTORS

MODEL	OUR PRICE	MODEL	OUR PRICE	MODEL	OUR PRICE
108 10 FOR	\$ 5.50	157 10 FOR	\$10.00	125 100 FOR	\$ 9.95
123A 10 FOR	3.95	159 10 FOR	5.50	177 20 FOR	9.95
152 10 FOR	8.00	186 10 FOR	10.00	506 10 FOR	8.00
153 10 FOR	8.00	197 10 FOR	10.00	712 5 FOR	10.00
154 10 FOR	12.00	198 10 FOR	12.50	SPECIAL 238 10 FOR	26.00

SPECTRUM IS NOT ASSOCIATED IN ANY WAY WITH PHILIPS ECG



NTE AND RCA TRIPLERS

PART No.	ORIGINAL BOXED	PRICES
SK 3304 / 500A		\$11.95 each 5 For 55.00
SK 3306 / 523 / 526		13.95 each 5 For 64.75
SK 3303 / 522		11.95 each
SK 3307 / 529		17.75 each 5 & Up 16.50 each
SK 3305 / 534		12.50 each
SK 3900 / 536		24.95 each
SK 3309 / 539		12.50 each
800-616	ZENITH FOCUS DIVIDER	4.50 each

CRITICAL SAFETY CAPS

PART No.	PART No.	PART No.
GE	MAGNAVOX	ZENITH
EP 25X55	250663-11	800-860
EP 25X60	250663-13	
EP 25X75	250663-17	PART No.
EP 25X78	250663-19	SEARS
EP 25X69		20-887-1
EP 25X79	ANY ASSORTMENT OF 5 for	\$17.50



KESTER SOLDER	.062 DIAMETER	\$ 9.95 each 3 For 28.00
BP SOLDER	.031 DIAMETER	10.95 each 3 For 30.00
SOLDER WICK	1/8 DIAMETER	10 For 9.95

RG-59U COAXIAL CABLE		
ALUMINIUM FOIL	\$49.95	1,000 FEET
COPPER BRAID	54.95	1,000 FEET

BSR-1 DROP-IN CHANGER \$29.95

REPLACEMENT JOYSTICKS \$9.95 PER PAIR



Spectrum
ELECTRONICS

WRITE FOR OUR
FREE CATALOGUE:

5930 MARKET ST.
PHILADELPHIA, PA
19139

PLEASE INDICATE METHOD OF
PAYMENT
\$25 Minimum Order
\$50 Minimum Order for Credit Cards
CHECK
MONEY ORDER
VISA
MASTER CARD
C.O.D. ORDERS ACCEPTED

SERVICE AND SHIPPING
CHARGE SCHEDULE
FOR ORDERS 400
\$25 \$50 \$5.00
\$50 \$250 \$6.50
\$250 \$500 \$7.50
\$500 \$750 \$10.00
\$750 \$1000 \$15.00

FOR ORDERS CALL
1-(800)-523-0721
EXT. 6
IN PA. CALL
(215)-748-3010

4164**64K DYNAMIC**
200 NS**\$595****TMM2016****2KX8 STATIC**
200 NS**\$415****STATIC RAMS**

2101	256 x 4 (450ns)	1.95
5101	256 x 4 (450ns) (cmos)	3.95
2102-1	1024 x 1 (450ns)	.89
2102L-4	1024 x 1 (450ns) (LP)	.99
2102L-2	1024 x 1 (250ns) (LP)	1.49
2111	256 x 4 (450ns)	2.49
2112	256 x 4 (450ns)	2.99
2114	1024 x 4 (450ns)	8/9.95
2114-25	1024 x 4 (250ns)	8/10.95
2114L-4	1024 x 4 (450ns) (LP)	8/12.95
2114L-3	1024 x 4 (300ns) (LP)	8/13.45
2114L-2	1024 x 4 (200ns) (LP)	8/13.95
2147	4096 x 1 (55ns)	4.95
TMS4044-4	4096 x 1 (450ns)	3.49
TMS4044-3	4096 x 1 (300ns)	3.99
TMS4044-2	4096 x 1 (200ns)	4.49
MK4118	1024 x 8 (250ns)	9.95
TMM2016-200	2048 x 8 (200ns)	4.15
TMM2016-150	2048 x 8 (150ns)	4.95
TMM2016-100	2048 x 8 (100ns)	6.15
HM6116-4	2048 x 8 (200ns) (cmos)	4.75
HM6116-3	2048 x 8 (150ns) (cmos)	4.95
HM6116-2	2048 x 8 (120ns) (cmos)	8.95
HM6116LP-4	2048 x 8 (200ns) (cmos)(LP)	5.95
HM6116LP-3	2048 x 8 (150ns) (cmos)(LP)	6.95
HM6116LP-2	2048 x 8 (120ns) (cmos)(LP)	10.95
Z-6132	4096 x 8 (300ns) (Qstat)	34.95

LP = Low Power Qstat = Quasi-Static

DYNAMIC RAMS

TMS4027	4096 x 1 (250ns)	1.99
UPD411	4096 x 1 (300ns)	3.00
MM5280	4096 x 1 (300ns)	3.00
MK4108	8192 x 1 (200ns)	1.95
MM5298	8192 x 1 (250ns)	1.85
4116-300	16384 x 1 (300ns)	8/11.75
4116-250	16384 x 1 (250ns)	8/11.95
4116-200	16384 x 1 (200ns)	8/12.95
4116-150	16384 x 1 (150ns)	8/14.95
4116-120	16384 x 1 (120ns)	8/29.95
2118	16384 x 1 (150ns) (5v)	4.95
4164-200	65536 x 1 (200ns) (5v)	5.95
4164-150	65536 x 1 (150ns) (5v)	6.95

5V = single 5 volt supply

EPROMS

1702	256 x 8 (1us)	4.50
2708	1024 x 8 (450ns)	3.95
2758	1024 x 8 (450ns) (5v)	5.95
2716	2048 x 8 (450ns) (5v)	3.95
2716-1	2048 x 8 (350ns) (5v)	5.95
TMS2516	2048 x 8 (450ns) (5v)	5.50
TMS2716	2048 x 8 (450ns)	7.95
TMS2532	4096 x 8 (450ns) (5v)	5.95
2732	4096 x 8 (450ns) (5v)	4.95
2732-250	4096 x 8 (250ns) (5v)	8.95
2732-200	4096 x 8 (200ns) (5v)	11.95
2764	8192 x 8 (450ns) (5v)	9.95
2764-250	8192 x 8 (250ns) (5v)	14.95
2764-200	8192 x 8 (200ns) (5v)	24.95
TMS2564	8192 x 8 (450ns) (5v)	17.95
MC68764	8192 x 8 (450ns) (5v) (24 pin)	39.95
27128	16384x8 Call	Call

5v = Single 5 Volt Supply

EPROM ERASERS

	Timer	Capacity Chip	Intensity (uW/Cm ²)	
PE-14		6	5,200	83.00
PE-14T	X	6	5,200	119.00
PE-24T	X	9	6,700	175.00
PL-265T	X	20	6,700	255.00
PR-125T	X	16	15,000	349.00
PR-320	X	32	15,000	595.00

Z-80

2.5 Mhz

Z80-CPU	3.95
Z80-CTC	4.49
Z80-DART	10.95
Z80-DMA	14.95
Z80-PIO	4.49
Z80-SIO/0	16.95
Z80-SIO/1	16.95
Z80-SIO/2	16.95
Z80-SIO/9	16.95

4.0 Mhz

Z80A-CPU	4.95
Z80A-CTC	4.95
Z80A-DART	11.95
Z80A-DMA	16.95
Z80A-PIO	4.95
Z80A-SIO/0	16.95
Z80A-SIO/1	16.95
Z80A-SIO/2	16.95
Z80A-SIO/9	16.95

6.0 Mhz

Z80B-CPU	11.95
Z80B-CTC	13.95
Z80B-PIO	13.95
Z80B-DART	19.95

ZILOG

Z6132	34.95
Z8671	39.95

CRYSTALS

32.768 khz	1.95
1.0 mhz	4.95
1.8432	4.95
2.0	3.95
2.097152	3.95
2.4576	3.95
3.2768	3.95
3.579535	3.95
4.0	3.95
5.0	3.95
5.0688	3.95
5.185	3.95
5.7143	3.95
6.0	3.95
6.144	3.95
6.5536	3.95
8.0	3.95
10.0	3.95
10.738635	3.95
14.31818	3.95
15.0	3.95
16.0	3.95
17.430	3.95
18.0	3.95
18.432	3.95
20.0	3.95
22.1184	3.95
32.0	3.95

CRT

6845	14.95
68B45	19.95
HD46505SP	15.95
6847	11.95
MC1372	6.95
68047	24.95
8275	29.95
7220	99.95
CRT5027	39.95
CRT5037	49.95
TMS9918A	39.95
DP8350	49.95

**KEYBOARD
CHIPS**

AY5-2376	11.95
AY5-3600	11.95
AY5-3600 PRO	11.95

8000

8035	5.95
8039	6.95
INS-8060	17.95
INS-8073	24.95
8080	3.95
8085	5.95
8085A-2	11.95
8086	29.95
8087	CALL
8088	39.95
8089	89.95
8155	6.95
8155-2	7.95
8156	6.95
8185	29.95
8185-2	39.95
8741	39.95
8748	24.95
8755	24.95

8200

8202	24.95
8203	39.95
8205	3.50
8212	1.80
8214	3.85
8216	1.75
8224	2.25
8226	1.80
8228	3.49
8237	19.95
8237-5	21.95
8238	4.49
8243	4.45
8250	10.95
8251	4.49
8253	6.95
8253-5	7.95
8255	4.49
8255-5	5.25
8257	7.95
8257-5	8.95
8259	6.90
8259-5	7.50
8271	39.95
8272	39.95
8275	29.95
8279	8.95
8279-5	10.00
8282	6.50
8283	6.50
8284	5.50
8286	6.50
8287	6.50
8288	25.00
8289	49.95

**DISC
CONTROLLERS**

1771	16.95
1791	24.95
1793	26.95
1795	49.95
1797	49.95
2791	54.95
2793	54.95
2795	59.95
2797	59.95
6843	34.95
8272	39.95
UPD765	39.95
MB8876	29.95
MB8877	34.95
1691	17.95
2143	18.95

CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
XR2206	1.25
S-100 ST	3.95

6800

68000	59.95
6800	3.95
6802	7.95
6808	13.90
6809E	19.95
6809	11.95
6810	2.95
6820	4.35
6821	3.25
6828	14.95
6840	12.95
6843	34.95
6844	25.95
6845	14.95
6847	11.95
6850	3.25
6852	5.75
6860	9.95
6862	11.95
6875	6.95
6880	2.25
6883	22.95
68047	24.95
68488	19.95

6800 - 1MHZ

68B00	10.95
68B02	22.25
68B09E	29.95
68B09	29.95
68B10	6.95
68B21	6.95
68B45	19.95
68B50	5.95

68B00 = 2 MHZ**6500**

6502	4.95
6504	6.95
6505	8.95
6507	9.95
6520	4.35
6522	7.95
6532	9.95
6545	22.50
6551	11.85

2 MHZ

6502A	6.95
6522A	9.95
6532A	11.95
6545A	27.95
6551A	11.95

3 MHZ

6502B	14.95
-------	-------

UARTS

AY3-1014	6.95
AY5-1013	3.95
AY3-1015	6.95
PT1472	9.95
TR1602	3.95
2350	9.95
2651	8.95
TMS6011	5.95
IM6402	7.95
IM6403	8.95
INS8250	10.95

**GENERATORS
BIT-RATE**

MC14411	11.95
BR1941	11.95
4702	12.95
COM5016	16.95
COM8116	10.95
MM5307	10.95

FUNCTION

MC4024	3.95
LM566	1.49
XR2206	3.75
8038	3.95

74LS00

74LS00	.24	74LS173	.69
74LS01	.25	74LS174	.55
74LS02	.25	74LS175	.55
74LS03	.25	74LS181	2.15
74LS04	.24	74LS189	8.95
74LS05	.25	74LS190	.89
74LS08	.28	74LS191	.89
74LS09	.29	74LS192	.79
74LS10	.25	74LS193	.79
74LS11	.35	74LS194	.69
74LS12	.35	74LS195	.69
74LS13	.45	74LS196	.79
74LS14	.59	74LS197	.79
74LS15	.35	74LS221	.89
74LS20	.25	74LS240	.95
74LS21	.29	74LS241	.99
74LS22	.25	74LS242	.99
74LS26	.29	74LS243	.99
74LS27	.29	74LS244	1.29
74LS28	.35	74LS245	1.49
74LS30	.25	74LS247	.75
74LS32	.29	74LS248	.99
74LS33	.55	74LS249	.99
74LS37	.35	74LS251	.59
74LS38	.35	74LS253	.59
74LS40	.25	74LS257	.59
74LS42	.49	74LS258	.59
74LS47	.75	74LS259	2.75
74LS48	.75	74LS260	.59
74LS49	.75	74LS266	.55
74LS51	.25	74LS273	1.49
74LS54	.29	74LS275	3.35
74LS55	.29	74LS279	.49
74LS63	1.25	74LS280	1.98
74LS73	.39	74LS283	.69
74LS74	.35	74LS290	.89
74LS75	.39	74LS293	.89
74LS76	.39	74LS295	.99
74LS78	.49	74LS298	.89
74LS83	.60	74LS299	1.75
74LS85	.69	74LS323	3.50
74LS86	.39	74LS324	1.75
74LS90	.55	74LS352	1.29
74LS91	.89	74LS353	1.29
74LS92	.55	74LS363	1.35
74LS93	.55	74LS364	1.95
74LS95	.75	74LS365	.49
74LS96	.89	74LS366	.49
74LS107	.39	74LS367	.45
74LS109	.39	74LS368	.45
74LS112	.39	74LS373	1.39
74LS113	.39	74LS374	1.39
74LS114	.39	74LS377	1.39
74LS122	.45	74LS378	1.18
74LS123	.79	74LS379	1.35
74LS124	2.90	74LS385	1.90
74LS125	.49	74LS386	.45
74LS126	.49	74LS390	1.19
74LS132	.59	74LS393	1.19
74LS133	.59	74LS395	1.19
74LS136	.39	74LS399	1.49
74LS137	.99	74LS424	2.95
74LS138	.55	74LS447	.37
74LS139	.55	74LS490	1.95
74LS145	1.20	74LS624	3.99
74LS147	2.49	74LS640	2.20
74LS148	1.35	74LS645	2.20
74LS151	.55	74LS668	1.69
74LS153	.55	74LS669	1.89
74LS154	1.90	74LS670	1.49
74LS155	.69	74LS674	9.65
74LS156	.69	74LS682	3.20
74LS157	.65	74LS683	3.20
74LS158	.59	74LS684	3.20
74LS160	.69	74LS685	3.20
74LS161	.65	74LS688	2.40
74LS162	.69	74LS689	3.20
74LS163	.65	74LS783	24.95
74LS164	.69	81LS95	1.49
74LS165	.95	81LS96	1.49
74LS166	1.95	81LS97	1.49
74LS168	1.75	81LS98	1.49
74LS169	1.75	25LS2521	2.80
74LS170	1.49	25LS2569	4.25

2114

450 NS

8/\$995

2114

250 NS

8/\$1095

7400

7400	.19	74132	.45
7401	.19	74136	.50
7402	.19	74141	.65
7403	.19	74142	2.95
7404	.19	74143	2.95
7405	.25	74145	.60
7406	.29	74147	1.75
7407	.29	74148	1.20
7408	.24	74150	1.35
7409	.19	74151	.55
7410	.19	74152	.65
7411	.25	74153	.55
7412	.30	74154	1.25
7413	.35	74155	.75
7414	.49	74156	.65
7416	.25	74157	.65
7417	.25	74159	1.65
7420	.19	74160	.85
7421	.35	74161	.69
7422	.35	74162	.85
7423	.29	74163	.69
7425	.29	74164	.85
7426	.29	74165	.85
7427	.29	74166	1.00
7428	.45	74167	2.95
7430	.19	74170	1.65
7432	.29	74172	5.95
7433	.45	74173	.75
7437	.29	74174	.89
7438	.29	74175	.89
7440	.19	74176	.89
7442	.49	74177	.75
7443	.65	74178	1.15
7444	.69	74179	1.75
7445	.69	74180	.75
7446	.69	74181	2.25
7447	.69	74182	.75
7448	.69	74184	2.00
7450	.19	74185	2.00
7451	.23	74190	1.15
7453	.23	74191	1.15
7454	.23	74192	.79
7460	.23	74193	.79
7470	.35	74194	.85
7472	.29	74195	.85
7473	.34	74196	.79
7474	.33	74197	.75
7475	.45	74198	1.35
7476	.35	74199	1.35
7480	.59	74221	1.35
7481	1.10	74246	1.35
7482	.95	74247	1.25
7483	.50	74248	1.85
7485	.59	74249	1.95
7486	.35	74251	.75
7489	2.15	74259	2.25
7490	.35	74265	1.35
7491	.40	74273	1.95
7492	.50	74276	1.25
7493	.35	74279	.75
7494	.65	74283	2.00
7495	.55	74284	3.75
7496	.70	74285	3.75
7497	2.75	74290	.95
74100	1.75	74293	.75
74107	.30	74298	.85
74109	.45	74351	2.25
74110	.45	74365	.65
74111	.55	74366	.65
74116	1.55	74367	.65
74120	1.20	74368	.65
74121	.29	74376	2.20
74122	.45	74390	1.75
74123	.49	74393	1.35
74125	.45	74425	3.15
74126	.45	74426	.85
74128	.55	74490	2.55

LINEAR

LM301	.34	LM340 (see 7800)	
LM301H	.79	LM348	.99
LM307	.45	LM350K	4.95
LM308	.69	LM350T	4.60
LM308H	1.15	LM358	.69
LM309H	1.95	LM359	1.79
LM309K	1.25	LM376	3.75
LM310	1.75	LM377	1.95
LM311	.64	LM378	2.50
LM311H	.89	LM379	4.50
LM312H	1.75	LM380	.89
LM317K	3.95	LM380N-8	1.10
LM317T	1.19	LM381	1.60
LM318	1.49	LM382	1.60
LM318H	1.59	LM383	1.95
LM319H	1.90	LM384	1.95
LM319	1.25	LM386	.89
LM320 (see 7900)		LM387	1.40
LM322	1.65	LM389	1.35
LM323K	4.95	LM390	1.95
LM324	.59	LM392	.69
LM329	.65	LM394H	4.60
LM331	3.95	LM399H	5.00
LM334	1.19	NE531	2.95
LM335	1.40	NE555	.34
LM336	1.75	NE556	.65
LM337K	3.95	NE558	1.50
LM337T	1.95	NE561	24.95
LM338K	6.95	NE564	2.95
LM339	.99	LM565	.99

H = TO-5 CAN

T = TO-220

K = TO-3

RCA

CA 3023	2.75	CA 3082	1.65
CA 3039	1.29	CA 3083	1.55
CA 3046	1.25	CA 3086	.80
CA 3059	2.90	CA 3089	2.99
CA 3060	2.90	CA 3096	3.49
CA 3065	1.75	CA 3130	1.30
CA 3080	1.10	CA 3140	1.15
CA 3081	1.65	CA 3146	1.85
CA 3160	1.19		

TI

TL494	4.20	75365	1.95
TL496	1.65	75450	.59
TL497	3.25	75451	.39
75107	1.49	75452	.39
75110	1.95	75453	.39
75150	1.95	75454	.39
75154	1.95	75491	.79
75188	1.25	75492	.79
75189	1.25	75493	.89
75494	.89		

BI FET

TL071	.79	TL084	2.19
TL072	1.19	LF347	2.19
TL074	2.19	LF351	.60
TL081	.79	LF353	1.00
TL082	1.19	LF355	1.10
TL083	1.19	LF356	1.10
LF357	1.40		

CMOS

4000	.29	4527	1.95
4001	.25	4528	1.19
4002	.25	4531	.95
4006	.89	4532	1.95
4007	.29	4538	1.95
4008	.95	4539	1.95
4009	.39	4541	2.64
4010	.45	4543	1.19
4011	.25	4553	5.79
4012	.25	4555	.95
4013	.38	4556	.95
4014	.79	4581	1.95
4015	.39	4582	1.95
4016	.39	4584	.75
4017	.69	4585	.75
4018	.79	4702	12.95
4019	.39	74C00	.35
4020	.75	74C02	.35
4021	.79	74C04	.35
4022	.79	74C08	.35
4023	.29	74C10	.35
4024	.65	74C14	.59
4025	.29	74C20	.35
4026	1.65	74C30	.35
4027	.45	74C32	.39
4028	.69	74C42	1.29
4029	.79	74C48	1.99
4030	.39	74C73	.65
4034	1.95	74C74	.65
4035	.85	74C76	.80
4040	.75	74C83	1.95
4041	.75	74C85	1.95
4042	.69	74C86	.39
4043	.85	74C89	4.50
4044	.79	74C90	1.19
4046	.85	74C93	1.75
4047	.95	74C95	.99
4049	.35	74C107	.89
4050	.35	74C150	5.75
4051	.79	74C151	2.25
4053	.79	74C154	3.25
4060	.89	74C157	1.75
4066	.39	74C160	1.19
4068	.39	74C161	1.19
4069	.29	74C162	1.19
4070	.35	74C163	1.19
4071	.29	74C164	1.39
4072	.29	74C165	2.00
4073	.29	74C173	.79
4075	.29	74C174	1.19
4076	.79	74C175	1.19
4078	.29	74C192	1.49
4081	.29	74C193	1.49
4082	.29	74C195	1.39
4085	.95	74C200	5.75
4086	.95	74C221	1.75
4093	.49	74C373	2.45
4098	2.49	74C374	2.45
4099	1.95	74C901	.39
14409	12.95	74C902	.85
14410	12.95	74C903	.85
14411	11.95	74C905	10.95
14412	12.95	74C906	.95
14419	7.95	74C907	1.00
14433	4.18	74C908	2.00
4502	.95	74C909	2.75
4503	.65	74C910	9.95
4508	1.95	74C911	8.95
4510	.85	74C912	8.95
4511	.85	74C914	1.95
4512	.85	74C915	1.19
4514	1.25	74C918	2.75
4515	1.79	74C920	17.95
4516	1.55	74C921	15.95
4518	.89	74C922	4.49
4519	.39	74C923	4.95
4520	.79	74C925	5.95
4522	1.25	74C926	7.95
4526	1.25	74C928	7.95
		74C929	19.95

74S00

74S00	.32	74S163	1.95
74S02	.35	74S168	3.95
74S03	.35	74S169	3.95
74S04	.35	74S174	.95
74S05	.35	74S175	.95
74S08	.35	74S181	3.95
74S09	.40	74S182	2.95
74S10	.35	74S188	1.95
74S11	.35	74S189	6.95
74S15	.35	74S194	1.49
74S20	.35	74S195	1.49
74S22	.35	74S196	1.49
74S30	.35	74S197	1.49
74S32	.40	74S201	6.95
74S37	.88	74S225	7.95
74S38	.85	74S240	2.20
74S40	.35	74S241	2.20
74S51	.35	74S244	2.20
74S64	.40	74S251	.95
74S65	.40	74S253	.95
74S74	.50	74S257	.95
74S85	1.99	74S258	.95
74S86	.50	74S260	.79
74S112	.50	74S274	19.95
74S113	.50	74S275	19.95
74S114	.55	74S280	1.95
74S124	2.75	74S287	1.90
74S132	1.24	74S288	1.90
74S133	.45	74S289	6.89
74S134	.50	74S301	6.95
74S135	.89	74S373	2.45
74S138	.85	74S374	2.45
74S139	.85	74S381	7.95
74S140	.55	74S387	1.95
74S151	.95	74S412	2.98
74S153	.95	74S471	4.95
74S157	.95	74S472	4.95
74S158	.95	74S474	4.95
74S161	1.95	74S482	15.25
74S162	1.95	74S570	2.95
		74S571	2.95

IC SOCKETS

8 pin ST	1.99	100
14 pin ST	.13	.11
16 pin ST	.15	.12
18 pin ST	.17	.13
20 pin ST	.20	.18
22 pin ST	.29	.27
24 pin ST	.30	.27
28 pin ST	.30	.27
40 pin ST	.49	.39
64 pin ST	4.25	call
ST = SOLDERTAIL		
8 pin WW	.59	.49
14 pin WW	.69	.52
16 pin WW	.69	.58
18 pin WW	.99	.90
20 pin WW	1.09	.98
22 pin WW	1.39	1.28
24 pin WW	1.49	1.35
28 pin WW	1.69	1.49
40 pin WW	1.99	1.80
WW = WIREWRAP		
16 pin ZIF	6.75	call
24 pin ZIF	9.95	call
28 pin ZIF	10.95	call
ZIF = TEXT TOOL		
(Zero Insertion Force)		

LED LAMPS

Red	.10	.09
Green	.18	.15
Yellow	.18	.15

LED DISPLAYS

HP 5082-7760	.6"	CC	1.29
MAN 72	.3"	CA	.99
MAN 74	.3"	CC	.99
FND-357 (359)	.375"	CC	1.25

CABINETS FOR 5 1/4" DISK DRIVES

CABINET #1 \$29.95

- * DIMENSIONS 8 3/4" x 5 1/4" x 3 1/4"
- * COLOR MATCHES APPLE
- * FITS STANDARD 5 1/4" DRIVES, INCL. SHUGART
- * INCLUDES MOUNTING HARDWARE AND FEET

CABINET #2 \$79.00

- * COMPLETE WITH POWER SUPPLY, SWITCH, LINE CORD, FUSE & STANDARD POWER CONNECTOR
 - * DIMENSIONS: 11 1/2" x 5 1/4" x 3 1/4"
 - * +5V @ 1 AMP, +12V @ 1.5 AMP
 - * FITS STANDARD 5 1/4" DRIVES
 - * PLEASE SPECIFY GRAY OR TAN
- NOTE: Please include sufficient amount for shipping on above items.

CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95
72 pin ST	6.95
72 pin WW	7.95
50 pin ST	4.95
44 pin ST	2.95
44 pin WW	4.95
72 pin SE	3.95

MUFFIN FANS

NEW UN-USED	
4.68" Square	14.95
3.125" Square	14.95

OPTO-ISOLATORS

4N26	1.00
4N27	1.10
4N28	.69
4N33	1.75
4N35	1.25
4N37	1.25
MCT-2	1.00
MCT-6	1.50
MCA-7	4.25
MCA-255	1.75
IL-1	1.25
ILA-30	1.25
ILQ-74	2.75
H11C5	1.25
TIL-111	1.00
TIL-113	1.75

RESISTORS

1/4 WATT 5% CARBON FILM ALL STANDARD VALUES FROM 1 OHM TO 10 MEG OHM

50 PCS. SAME VALUE	.025
100 PCS. SAME VALUE	.02
1000 PCS. SAME VALUE	.015

BYPASS CAPS

.01 UF DISC	100/6.00
.1 UF DISC	100/8.00
.1 UF MONOLITHIC	100/15.00

WE HAVE THE COMPLETE LINE OF DISC, TANTALUM AND ELECTROLYTIC CAPACITORS IN STOCK!

TRANSISTORS

2N918	.50	MPS3706	.15
MPS918	.25	2N3772	1.85
2N2102	.70	2N3903	.25
2N2218	.50	2N3904	.10
2N2218A	.50	2N3906	.10
2N2219	.50	2N4122	.25
2N2219A	.50	2N4123	.25
2N2222	.25	2N4249	.25
PN2222	.10	2N4304	.75
MPS2369	.25	2N4401	.25
2N2484	.25	2N4402	.25
2N2905	.50	2N4403	.25
2N2907	.25	2N4857	1.00
PN2907	.125	PN4916	.25
2N3055	.79	2N5086	.25
3055T	.69	PN5129	.25
2N3393	.30	PN5139	.25
2N3414	.25	2N5209	.25
2N3563	.40	2N6028	.35
2N3565	.40	2N6043	1.75
PN3565	.25	2N6045	1.75
MPS3638	.25	MPS-A05	.25
MPS3640	.25	MPS-A06	.25
PN3643	.25	MPS-A55	.25
PN3644	.25	TIP29	.65
MPS3704	.15	TIP31	.75
		TIP32	.79

MICROCOMPUTER

HARDWARE HANDBOOK FROM ELCOMP — \$14.95

Over 800 pages of manufacturers data sheets on most commonly used IC's.

Includes:

- * TTL — 74/74LS and 74F
- * CMOS
- * Voltage Regulators
- * Memory — RAM, ROM, EPROM
- * CPU's — 6800, 6500, Z80, 8080, 8085, 8086/8
- * MPU support & interface — 6800, 6500, Z80, 8200, etc.

HEAT SINKS

TO-3 style	.95
TO-220 style	.35

DISK DRIVES TANDON

TM100-1 5 1/4" (FOR IBM) SS/DD	229.00
TM100-2 5 1/4" (FOR IBM) DS/DD	295.00

SHUGART

SA 400L 5 1/4" (40 TRACK) SS/DD	199.95
SA 400 5 1/4" (35 TRACK) SS/DD	189.95

SIEMENS

FD100-8 8" SS/DD (SHUGART 801 EQUIVALENT)	189.00
---	--------

FD200-8 8" DS/DD (SHUGART 851 EQUIVALENT)	239.00
---	--------

PERTEC

FD-200 5 1/4" SS/DD	179.95
FD-250 5 1/4" DS/DD	199.95

MPI

MP-52 5 1/4" (FOR IBM) DS/DD	295.00
------------------------------	--------

NOTE: Please include sufficient amount for shipping on above items.

POWER SUPPLY MODEL 2 \$39.95

MOUNTED ON PC BOARD MANUFACTURED BY CONVER

+5 VOLT 4 AMP
±12 VOLT 1 AMP

NOTE: Please include sufficient amount for shipping on above items.

DIODES

1N751 5.1 volt zener	.25
1N759 12.0 volt zener	.25
1N4148 (1N914) switching	25/1.00
1N4004 400PIV rectifier	10/1.00
KBP02 200PIV 1.5amp bridge	.45
KBP04 400PIV 1.5amp bridge	.55
VM48 Dip-Bridge	.35

D-SUBMINIATURE

DESCRIPTION	SOLDER CUP		RIGHT ANGLE PC SOLDER		IDC RIBBON CABLE		HOODS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	BLACK	GREY
ORDER BY	DBxxP	DBxxS	DBxxPR	DBxxSR	IDBxxP	IDBxxS	HOOD-B	HOOD
CONTACTS 9	2.08	2.66	1.65	2.18	3.37	3.69	---	1.60
15	2.69	3.63	2.20	3.03	4.70	5.13	---	1.60
25	2.50	3.25	3.00	4.42	6.23	6.84	1.25	1.25
37	4.80	7.11	4.83	6.19	9.22	10.08	---	2.95
50	6.06	9.24	---	---	---	---	---	3.50

For order instructions see "IDC Connectors" below.

CALL FOR MOUNTING HARDWARE

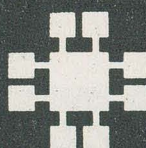
RIBBON CABLE

CONTACTS	SINGLE COLOR		COLOR CODED	
	1'	10'	1'	10'
10	.50	4.40	.83	7.30
16	.55	4.80	1.00	8.80
20	.65	5.70	1.25	11.00
25	.75	6.60	1.32	11.60
26	.75	6.60	1.32	11.60
34	.98	8.60	1.65	14.50
40	1.32	11.60	1.92	16.80
50	1.38	12.10	2.50	22.00

IDC CONNECTORS

DESCRIPTION	SOLDER HEADER	RIGHT ANGLE SOLDER HEADER	WW HEADER	RIGHT ANGLE WW HEADER	RIBBON HEADER SOCKET	RIBBON HEADER	RIBBON EDGE CARD
ORDER BY	IDHxxS	IDHxxSR	IDHxxW	IDHxxWR	IDSxx	IDMxx	IDExx
CONTACTS 10	.82	.85	1.86	2.05	1.15	---	2.25
20	1.29	1.35	2.98	3.28	1.86	5.50	2.36
26	1.68	1.76	3.84	4.22	2.43	6.25	2.65
34	2.20	2.31	4.50	4.45	3.15	7.00	3.25
40	2.58	2.72	5.28	4.80	3.73	7.50	3.80
50	3.24	3.39	6.63	7.30	4.65	8.50	4.74

ORDERING INSTRUCTIONS: Insert the number of contacts in the position marked "xx" of the "order by" part number listed. **Example:** A 10 pin right angle solder style header would be IDH10SR.



JDR Microdevices

1224 S. Bascom Avenue

San Jose, CA 95128

800-538-5000 • 800-662-6279 (CA)

(408) 995-5430 • Telex 171-110

1983 JDR MICRODEVICES, INC.

VISIT OUR RETAIL STORE

— NEW HOURS —
M-W-F, 9-5
T-Th., 9-9 Sat. 11-3

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

TERMS: For shipping include \$2 for UPS Ground or \$3 for UPS Blue Label Air. Items over 5 pounds require additional shipping charges. Foreign orders include sufficient amount for shipping. There is a \$10 minimum order. Bay Area and Los Angeles Counties add 6% Sales Tax. Other California residents add 6% Sales Tax. We reserve the right to substitute manufacturer. Not responsible for typographical errors. Prices are subject to change without notice. We will match or beat any competitor's price provided it is not below our cost.

FOR APPLE COMPUTER USERS

FD-35 DISK DRIVE

- ★ Direct Replacement for Apple Disk II
- ★ Compatible with Apple Controller or other Apple compatible controllers
- ★ Specially designed electronics with **low power consumption**
- ★ DOS 3.3 and 3.2 compatible
- ★ Owner's Manual and Warranty Card included

NOW
WITH ONE YEAR \$229⁹⁵
WARRANTY
CONTROLLER CARD \$89.95

VIEWMAX-80

A Full Function

- 80 Column Card for Apple II*
 ★ Soft Video Switch ★ Shift Key Support

2 YEAR WARRANTY
NOW ONLY \$189⁹⁵

5 1/4" DISKETTES VERBATIM DATALIFE

SS/DD SOFT SECTOR..... 29.95

SS/DD 10 SECTOR HEAD 29.95

NASHUA

SS/DD SOFT SECTOR
 WITH HUB RING **\$19⁹⁵**

Ask about our full
 line of Nashua diskettes

BEST BUY

THOUSANDS SOLD JDR 16K RAMCARD

- ★ Expand your 48K Apple to 64K
- ★ Fully compatible with Apple Language System — Use in place of Apple Language card
- ★ Provides extra memory for Visicalc™
- ★ Run PASCAL, FORTRAN, Integer Basic with appropriate software
- ★ Highest quality card features: gold edge connector, sockets for all IC's

WITH 2 YEAR WARRANTY

**ASSEMBLED & TESTED
 WITH WARRANTY \$44⁹⁵**

**KIT — INCLUDES ALL
 PARTS & INSTRUCTIONS \$40⁹⁵**

**BARE PC CARD
 WITH INSTRUCTIONS \$14⁹⁵**

APPLE COMPATIBLE POWER SUPPLY \$99.95

- ★ Compact Switching Design
- ★ All Outputs regulated
- ★ Short Circuit and Overload Protection
- ★ Complete with Apple-type plug-in power cord
- ★ Apple Compatible — Yet higher output allows more disk drives and cards without overheating
- ★ +5V @ .5A, +12V @ .3A, -5V @ .5A, -12V @ .5A
- ★ Shielded enclosure: 10 3/4" x 3 1/2" x 2 1/16"

NEW IMPROVED JDR COOLING FAN

- ★ Easy modification — no modification of Apple required
- ★ Eliminates overheating problems
- ★ Switch on front controls fan, Apple, and extra outlet
- ★ Rotron whisper fan is the quietest, most reliable on the market

**NOW WITH SURGE
 SUPPRESSION
 \$69.95**

**WITHOUT SURGE
 SUPPRESSION \$59.95**

MONITORS MONOCHROME

NEC JB1201M - 20 MHZ GREEN \$169

ZENITH ZUM-121 - 15 MHZ GREEN \$99

TAXAN 18 MHZ AMBER \$139

COLOR

AMDEK COLOR I - COMPOSITE \$335
 NO C.O.D. ORDERS PLEASE

ORDER TOLL FREE
800-538-5000
800-662-6279
 (CALIFORNIA RESIDENTS)

ACCESSORIES FOR APPLE II & IIE

ALL WITH 1 YEAR WARRANTY BY



PRINTERLINK

CENTRONICS
 PARALLEL INTERFACE

- ★ Simple to use — No configuring required
- ★ Use with any centronics printer — EPSON, OKIDATA, etc.
- ★ Includes Cable & Manual

\$59⁰⁰

MESSENGER

SERIAL
 INTERFACE

- ★ Connects to any RS-232 serial device
- ★ 8 switch selectable drivers for printers, terminals and modems
- ★ Includes Cable & Manual

\$99⁰⁰

TIMELINK

REAL TIME
 CLOCK

- ★ Applications in file management, word processing, communications, etc.
- ★ Exclusive Alarm Clock feature
- ★ Battery recharges automatically

\$84⁰⁰

NEW BUFFERLINK

ADD-ON
 PRINTER BUFFER

- ★ Saves Time — No more waiting for printed output
- ★ Connects easily to any parallel interface
- ★ Expandable from 16K to 64K

\$139⁰⁰ (16K)

ORDER TOLL FREE
ALL MERCHANDISE
100% GUARANTEED

800-538-5000



© 1983 JDR MICRODEVICES, INC.

800-662-6279
 (CALIFORNIA RESIDENTS)

CALL US FOR VOLUME QUOTES

KNAPCO

G.E. MOV Spike Eliminators
V130-LA-10A
10/\$9.90 \$1.09 115V

Tri-Color LEDs
Red/Green reverse volt.
Yellow A.C.
100/60.00 2/\$1.50

3 CONDUCTOR EQUIPMENT CORDS
6' SHIELDED - MATES TO RFI FILTER
\$2.49

115 V. BLOCK FANS
3" SQ. \$6.95
FAN 31 2/\$10.00

ULTRASONIC BUG ELIMINATOR
IC BASE CIRCUITRY WITH PIEZO BOARD W/COMPONENTS CASE AND A.C. ADAPTOR
ELIMINATE COCKROACHES, FLEAS, BUGS.
KIT \$15.95

Dual Computer Chip Set
2 CPU & MPU Systems/Dual - Clocks, ACULU.
512 X 8 Bi Polar Ram 50 usec. & support
R 29623 Bi Polar Ram
74LS624 Volt Cont. Osc.
74121 (2) 7413 (2)
29701 64 X 8 Prom
MC 8601 Monostable, Retrigger.
Multivibrator (2)
CA 3246 Quad 20 MA. OP AMP.
6503 CPU
8048 MPU
723 Reg.
TMS 9901 Prog. Keyboard Interface
\$9.95

SEND FOR FREE CATALOG
or call us at
(813) 392-0406

Varactor Diodes
Hyper-Abrupt Diode Above 1 Ghz.
Mini-L Pack Motorola BB 105 39¢
Solder Paste
Must For Leadless Work 35 Grams
Liquid Solder 60/40 Rosin Base 49¢
Injection Pack Per Tube

DELUXE PROJECT CASE
Bik. Injection Molded Recessed Panel w/Strain Relief.
4" x 4 1/2" x 1 1/2"
10/30.00 \$3.25
100/225.00
1000/2000.00

PROJECT CASE
Plastic Case w/Base Flange Hinge Front Cord-Out Hole
3" x 4" x 2" H. 99¢
10/8.90
100/75.00

POWER INVERTER
12V. to 115V. Tripp Lite 450 Watt
\$89.95
PV400
Full Warranty Reg. OEM \$139.95

ITT Power Supply
Triple or Dual Choice Of
+12V. 7A -12V 7A or 24V. 7A.
And 5V. 10A.
\$300.00 Orig. Teletype Cost
5" X 5" High X 14" \$59.95

4 WATT AMPLIFIER
TI SN 76002ND (LM 384) 99¢
add 10% for shipping and handling

H.J. Knapp of Florida, Inc.
4750 96th St. N. St. Petersburg, Florida 33708
CIRCLE 4 ON FREE INFORMATION CARD

"AUTO LIGHT-OFF"
AUTO LIGHT OFF UNIT
— ADJUSTABLE DELAY —
2 1/2V. 10 AMP
RELAY TRIGGERED CIRCUITS
SOLD SEARS \$39.95 \$4.95

Voltage Regulators
+5V. 7805
+8V. 7808
+12V. 7812
+18V. 7818
+24V. 7824
5/\$5.50 10/\$9.95

MOTOROLA PIEZO SPEAKERS
Ultra Sonic Transducers
KSN1005A 3 1/4" \$6.95
RESPONSE 10/\$55.00
60 TO 30,000 Hz 100/\$450.00

Milton Bradley Computer Perfection
new boards w/ microprocessor
10/\$6.95 99¢

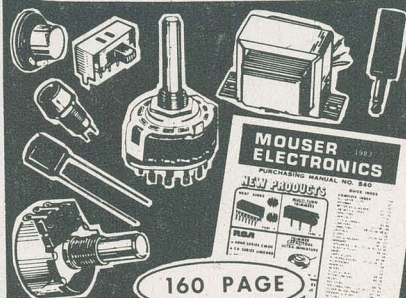
Piezo Elements
100/\$20. 39¢
Fantastic
Murata Transducer

TRANSFORMERS
10V./8 A + 46 V./2.5 A. C.T.
6, 7, 9, 12's @ 1 to 1.7 A.
\$6.95

Jumbo LEDs
100/\$5.00

Specialty Chips
TMS9900KDL CPU \$14.95
6514-5 CMOS RAM \$3.50
MM5280K 4K RAM \$3.00
IM6402 Uorts \$4.95
MC10125P Bus Driver \$3.50
MM1400ML CPU \$.59
4164-15NL 18.50 RAM 64K
MM1702 13.95 Eprom
4116 200NS. 8/15.50 Ram
8080A CPU \$1.95

ELECTRONIC COMPONENTS



FREE CATALOG

MANUFACTURERS OF QUALITY ELECTRONIC COMPONENTS

Battery Clips & Holders
Cable Sets Connectors Capacitors
Displays, LED Fuses Jacks & Plugs
Knobs Lamps Potentiometers
RF Coils Relays Resistors
Switches Semiconductors Speakers
Test Equipment Transformers Tools
Wire & Cable

WE STOCK What We Catalog !

- Sales and Order Desk Open from 6:00 a.m. (PST)
- TERMS: C.O.D., Visa, MasterCard (Open Accounts Available)
- Phone and Mail Orders Welcome
- Over 10,000 Different Items in Stock

MOUSER ELECTRONICS
11433 WOODSIDE AVE., SANTEE, CA 92071
PHONE: (619) 449-2222 TWX: 910-331-1175

CIRCLE 20 ON FREE INFORMATION CARD

MICROWAVE RECEIVER
1.9-2.5 GHz



- 50 dB gain
- 50 mile line of sight
- Complete power supply, cable antenna and probe.

RK-1 Assembled ... \$114.95
RK-1 Kit Form ... \$ 84.95

MICROWAVE RECEIVER
1.9-2.5 GHz

- Rod style
- 30 mile reception
- Complete system
- 32 element antenna
- Kit or assembled

RK-3 Assembled \$79.95
RK-3 Kit \$64.95

MICROWAVE PREAMP KIT!!!

- Use with RK-3 Kit. Add's 20-25 dB gain.
- Increase reception
- Low noise
- Use with all existing stop sign board receivers

MP-4 Kit \$38.95

AD-1 PULSEWAVE
Pulsewave Kit and Enclosure \$119.95
AD-1 Board Only ... \$19.95

UHF TV PREAMP

A very popular UHF Preamp Kit. Astounding signal amplification.

- Features:
- 27 dB gain
 - 2 dB noise factor
 - 75 ohm input/output
 - Enclosure & power supply included

CD-1 Preamp Kit ... \$34.95



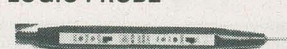
DIGITAL METER
MIC-3300A

- Assembled • 3 1/2 digits • DC .5% accuracy • DCA up to 10 amps • Ohm up to 20 M ohm • hFE measurement • Floating decimal point
- Leads + battery included

A high quality Digital Meter at an affordable price, the MIC 3300A is a high quality meter for all hobbyists and maintenance work.

MIC-3300A \$59.95
Carrying Case \$ 9.95

LOGIC PROBE



- Troubleshoot TTL-CMOS
- 4 LED states
- High input impedance
- Flexible clip on power leads
- Assembled & tested

L101A Logic Probe . \$34.95

TO ORDER CALL:
1-617-641-0778



CIRCLE 98 ON FREE INFORMATION CARD



Active Electronics

NUMBER ONE IN QUALITY SERVICE AVAILABILITY

THE WORLD'S MOST COMPLETE PROFESSIONAL AND HOME ELECTRONICS ENTHUSIAST INVENTORY

- Semiconductors + Memories
- Microprocessors + Support Circuits
- Microcomputer Systems + Peripherals
- Passive Electronic Components
- Hand Tools, Wire Wrapping, Soldering Equipment + Hardware

NOW AVAILABLE — FREE 1983 80-page catalog

A complete listing of products and specifications

Call, write or circle the inquiry card for your free copy today.

P.O. Box 8000, Westboro, Mass. 01581
CALL TOLL FREE: 1-800-343-0874

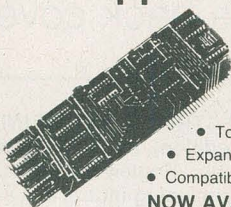
Mass customers call (617) 366-0500

CIRCLE 3 ON FREE INFORMATION CARD

ADVANCED COMPUTER PRODUCTS

SEND \$2.00 for 1983 CATALOG

16K Apple™ Ramcard



LIST 195

ACP
\$49⁹⁵

- Full 1 year warranty
- Top quality — gold fingers
- Expand Apple II 48K to 64K
- Compatible with Z-80 Softcard™

NOW AVAILABLE

Apple IIe 64K Add-in Memory with 80 Columns

\$149⁹⁵

RAM UP-GRADES

64K D RAM (4164-200ns)

9 pcs for \$50⁰⁰

16K D RAM (4116-200ns)

8 pcs for \$12⁹⁵

REPEAT OF SELL-OUT

58 Key Unencoded Keyboard



\$19⁹⁵ ea.

This is a new 58 key terminal Keyboard manufactured by a major manufacturer. It is unencoded with SPST keys unattached to any PC board. Solid molded plastic base measures 11 x 4

Unencoded Key Pad

15 key Keypad with 10 keys and tab return, (-), (.), and (,)

Only \$9⁹⁵ ea.

UV "EPROM" ERASER

Model DE-4

\$89⁹⁵

Holds 4 EPROM's at a time

Model S-52T

\$325.00

16K Memory Expansion Kits for Apple/TRS-80

8 pcs 4116 16K 200 250ns

Specify Computer

CALL FOR VOLUME PRICING

12⁹⁵

15 Amps 250 Volts

transient suppression

ACP Low Price

\$39⁹⁵

CONNECTORS

DB25P (RS232)

DB25S Female

Hood

Sel with Hood. Sale

22 44 S.T. KIM

4386 S.T. MOT

50 100 S-100 Connector W/W

50 100 S-100 Connector S.T

\$3.25

3.75

1.25

7.50

2.50

6.50

4.95

3.95

Special ACP Pricing

\$99⁰⁰

COEX 80-FT DOT MATRIX PRINTER

- 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing
- 2K Buffered Memory
- 80, 96, 132 Columns, Graphics and Block Printing
- Selectable Char Pitch, Line Spacing and Feed
- COEX Interface Card to Apple II — \$49.95
- Commodore Interface Card to VIC, 64, PET — \$79.95



\$199⁰⁰

MICROPROCESSORS

Z8001	\$99.00	8008-1	\$14.95	6802P	\$14.9
Z8002	69.00	2901	9.90	8035	14.95
Z80	9.95	2901A	14.95	8039	12.95
Z80A	11.95	9900L	49.95	8073N	34.95
F-8 (3850)	16.95	6502	9.95	8755	49.95
2650	16.95	6502A	16.95	8748	49.95
1802	9.75	IM6100	29.95	6809	30.00
6808A	4.75	6800	11.75	8086	49.00
8085	14.95	6800B	19.95	6800C	129.95

RAMS

6116-2016	\$7.95	2147	\$5.99	5200	\$1.99
8264-64K	5.95	411	5.99	5298	1.49
4116-2	1.99	414	4.69	6508	4.50
4116-2	8.12	95	1.01	99	6518
2101	3.99	1103	99	6561	3.79
2102	79	4027	4.69	6604	3.99
21L02-2	1.49	4044	3.99	6605	7.99
21L02-4	1.29	4050	4.69	9130	8.99
2111	3.49	4060	4.69	9140	8.99
2112	3.49	4096	3.99	93415	6.99
2114	1.99	4115	1.49	93425	6.99
2114-L-2	3.25	4200	7.95		
2114-L-4	2.29	4402	1.99		
2125	6.99	5280	4.60		

SUPPORT

8155	\$9.95	8259	\$8.95	68047	\$22.95
8156	9.95	8275	19.95	68488	19.95
8202	29.95	8279	9.50	46505	22.95
8205	2.69	6810	4.75	6520	6.95
8212	2.75	6820	6.50	6522	9.95
8214	4.95	6821	6.50	6530-X	24.95
8216	2.75	6828	10.50	6532	17.95
8224	2.95	6834	16.95	6551	19.95
8226	2.95	6845	22.95	280-PIO	6.50
8228	3.95	6847	27.95	280A-PIO	9.50
8243	9.50	6850	5.25	280-CTC	6.50
8250	14.95	6852	5.25	280A-CTC	9.50
8251	6.50	6860	10.95	280-DMA	14.95
8253	11.95	6862	10.95	280A-DMA	27.95
8255	4.50	6875	5.95	280-SIO	24.95
8257	9.50	6880	2.49	280A-SIO	24.95

MOS PROMS

2764 (8Kx8) TS	\$12.95	2708 (450ns)	\$5.75
2732 (4Kx8) TS	8.95	2708 (650ns)	5.25
2532 (4Kx8) TS	8.95	27128 (16Kx8)	39.95
2716 2516: 5V (2Kx8) TS	4.95	1702A	5.75
TMS2716 5V: 12V	17.95	MM5203ACQ	14.50
2758 5V: 450ns)	3.50	MM5204Q	9.95

HI-TECH

2513-001 (5V) Upper	\$9.50	DAC08	\$9.95
2513-005 (5V) Lower	10.95	DAC100	9.95
2513-ADM3 (5V) Lower	14.95	8038 Function Generator	4.50
MC66710 ASCII Shifted	12.95	MC4024 VCO	2.95
MC66740 Math Symbol	13.95	LM556 VCO	1.95
MC66750 Alpha Control	13.45	XR208 Function Generator	5.25
1771-01 8 & Midpoint	24.95	TR-6020 5V (2V)	4.95
1781 Dual Floppy	29.95	AY51013 (5V) (2V)	4.95
1791-01 Dual Floppy	36.95	AY51014A (16V) (5.14V)	6.95
1791-02 Dual Floppy	44.95	AY51015A (16V) (5.14V)	6.95
1793 DD DS Floppy	44.95	IM6402	7.95
1797 DD DS Floppy	54.95	IM6403	8.95
1691 Data Separator	18.95	7350 USRI	9.95
2143 Clock Generator	18.95	1671B Astable	24.95
8700 8 bit Binary	13.50	MC14411	11.95
8701 10 bit Binary	22.00	4702	14.95
8703 8 bit TS	13.50	WD1941	9.95
8900 Volt to Freq Conv	7.25	COM501H	16.95
8750 3 1/2 Digit BCD	13.95	IN5250A	19.95
1408L 6 bit	3.95	AY5-2376	13.75
1408L 8 bit	5.95	AY5-3600	13.75
DIAC01 D to A	5.95	MM5470AAC	8.95

SOCKETS

1-24	24-49	50-100
8 pin LP	16	15
14 pin LP	20	19
16 pin LP	22	21
18 pin LP	29	28
20 pin LP	34	32
22 pin LP	29	27
24 pin LP	38	37
28 pin LP	45	44
40 pin LP	60	59

LOW PROFILE SOCKETS (TIN)

1-24	24-49	50-100
8 pin WW	55	54
10 pin WW (Tin)	65	63
14 pin WW	75	73
16 pin WW	80	77
18 pin WW	95	90
20 pin WW	1.15	1.08
22 pin WW	1.45	1.35
24 pin WW	1.35	1.26
28 pin WW	1.60	1.53
40 pin WW	2.20	2.09

3L WIREWRAP SOCKETS (GOLD)

1-24	25-49	50-100
8 pin WW	55	54
10 pin WW (Tin)	65	63
14 pin WW	75	73
16 pin WW	80	77
18 pin WW	95	90
20 pin WW	1.15	1.08
22 pin WW	1.45	1.35
24 pin WW	1.35	1.26
28 pin WW	1.60	1.53
40 pin WW	2.20	2.09

LINEAR

78H05K	\$5.95	LM1414N	\$1.90
78L05	1.49	LM1458CN	.49
78M G	1.49	MC1488N	.99
LM106AH	2.95	MC1489N	.99
LM300H	.99	LM1496M	.89
LM301CN	.35	LM1556N	1.50
LM304H	1.98	LM1820N	.95
LM305H	1.89	LM1850N	.21
LM306H	3.25	LM1889N	3.10
LM307CN	.29	LM2111N	1.75
LM308CN	.98	LM2900N	.99
LM309K	1.49	LM2901N	2.50
LM310CN	1.25	LM2917N	2.95
LM311D CN	.89	CA3013T	1.99
LM312H	1.75	CA3018T	.99
LM317T	1.70	CA3021T	3.49
LM318CN	1.49	CA3023T	2.99
LM319H	1.25	CA3035T	2.75
LM320K-XX	1.35	CA3086N	1.29
LM320T-XX	1.39	CA3046N	1.29
LM320H-XX	1.25	LM3053N	1.49
LM323K	4.95	CA3059N	3.19
LM324N	.95	CA3060N	3.19
LM326K	4.95	CA3062N	4.95
LM338K	6.95	LM3065N	1.49
LM339N	.95	CA3080T	1.29
LM340K-XX	1.75	CA3081N	1.69
LM340T-XX	1.25	CA3082N	1.69
LM340H-XX	1.25	CA3083N	1.55
LM344H	1.99	CA344H	.80
LM348N	1.20	CA3089N	2.99
LM350K	5.60	CA3096N	3.49
LM358CN	.98	CA3097N	1.99
LM360N	1.49	CA3130T	1.30
LM372N	1.19	CA3140T	1.19
LM376N	3.75	CA3146N	2.49
LM377N	2.75	CA3160T	1.19
LM380CN	1.25	CA3190N	1.95
LM381N	1.79	CA3410N	.59
LM383T	1.95	MC3423N	1.49
LM384CN	1.25	MC3460N	1.49
LM387N	1.40	SG3524N	3.95
LM390N	1.95	CA3600N	3.39
NE531V T	3.75	LM3900N	.59
NE555V	.39	LM3905N	.99
NE556N	.98	LM3909N	1.19
NE561N	19.95	LM3914N	3.75
NE565H N	1.25	LM3915N	3.95
NE566H V	1.75	LM3916N	3.75
NE567H V	1.50	RC4136N	2.95
NE592N	2.75	RC4136N	1.10
RC4151N	1.99	RC4151N	3.20
LM709H N	.29	RC4194TK	4.95
LM710H N	.75	RC4195TK	5.40
LM711H N	.39	ULN2001	1.25
LM715N	1.95	ULN2003	1.50
LM723H N	.65	SN75451N	.59
LM733H N	.98	SN75451N	.39
LM739N	1.15	SN75452N	.49
LM741CN H	.33	SN75453N	.49
LM741CN-14	.19	SN75454N	.49
LM747H N	.75	SN75491N	.89
LM748H N	.39	SN75492N	.89
LM760CN	2.95	SN75493N	.89
LM1310N	1.90	SN75494N	.89
MC1330	1.95	TL494CN	4.20
MC1350	1.95	TL496CP	1.65
MC1358	1.75		

74S00

74S00	\$.39	74S124	\$3.69	74S244	\$2.99
74S02	.43	74S133	.54	74S251	1.35
74S03	.45	74S134	.66	74S253	1.35
74S04	.52	74S135	1.15	74S257	1.29
74S05	.52	74S136	1.69	74S258	1.29
74S06	.49	74S138	1.29	74S260	.75
74S08	.49	74S139	1.29	74S280	2.79
74S10	.42	74S140	.73	74S287	.29
74S11	.42	74S151	1.29	74S288	2.55
74S15	.42	74S153	1.69	74S373	1.10
74S20	.42	74S157	1.29	74S374	2.75
74S22	.42	74S158	1.29	74S387	3.10
74S30	.42	74S160	2.79	74S471	1.10
74S32	.49	74S174	1.49	74S473	2.75
74S38	1.19	74S175	1.49	74S473	2.75
74S40	.49	74S188	2.69	74S474	9.55
74S42	.49	74S194	1.49	74S475	9.55
74S44	.49	74S195	1.89	74S570	5.75
74S46	.46	74S196	1.89	74S571	5.75
74S48	.72	74S204	2.75	74S572	5.75
74S56	.72	74S242	2.75	74S573	5.75
74S57	.72	74S243	2.99	74S574	5.75
74S58	.72	74S243	2.99	74S574	5.75
74S59	.72	74S243	2.99	74S574	5.75
74S61	.72	74S243	2.99	74S574	5.75
74S62	.72	74S243	2.99	74S574	5.75
74S63	.72	74S243	2.99	74S574	5.75
74S64	.72	74S243	2.99	74S574	5.75
74S65	.72	74S243	2.99	74S574	5.75
74S66	.72	74S243	2.99	74S574	5.75
74S67	.72	74S243	2.99	74S574	5.75
74S68	.72	74S243	2.99	74S574	5.75
74S69	.72	74S243	2.99	74S574	5.75
74S70	.72	74S243	2.99	74S574	5.75
74S71	.72	74S243	2.99	74S574	5.75
74S72	.72	74S243	2.99	74S574	5.75
74S73	.72	74S243	2.99	74S574	5.75
74S74	.72	74S243	2.99	74S574	5.75
74S75	.72	74S243	2.99	74S574	5.75
74S76	.72	74S243	2.99	74S574	5.75
74S77	.72	74S243	2.99	74S574	5.75
74S78	.72	74S243	2.99	74S574	5.75
74S79	.72	74S243	2.99	74S574	5.75
74S80	.72	74S243	2.99	74S574	5.75
74S81	.72	74S243	2.99	74S574	5.75
74S82	.72	74S243	2.99	74S574	5.75
74S83	.72	74S243	2.99	74S574	5.75
74S84	.72	74S243	2.99	74S574	5.75
74S85	.72	74S243	2.99	74S574	5.75
74S86	.72	74S243	2.99	74S574	5.75
74S87	.72	74S243	2.99	74S574	5.75
74S88	.72	74S243	2.99	74S574	5.75
74S89	.72	74S243	2.99	74S574	5.75
74S90	.72	74S243	2.99	74S574	5.75
74S91	.72	74S243	2.99	74S574	5.75
74S92	.72	74S243	2.99	74S574	5.75
74S93	.72	74S243	2.99	74S574	5.75
74S94	.72	74S243	2.99	74S574	5.75
74S95	.72	74S243	2.99	74S574	5.75
74S96	.72	74S243	2.99	74S574	5.75
74S97	.72	74S243	2.99	74S574	5.75
74S98	.72	74S243	2.99	74S574	5.75
74S99	.72	74S243	2.99	74S574	5.75

NEW BOOKS

For more details use the free information card inside the back cover

COMPLETE GUIDE TO VIDEOCASSETTE RECORDER OPERATION AND SERVICE, by John D. Lenk; Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632; 365 pp. including index; 6 1/4 x 9 1/4 inches; hardcover; \$22.95.

This is a simplified, practical system of operation and service for a cross-section of VCR's, both Beta and VHS. The author concentrates on a basic service and trouble-shooting approach, based on the techniques used in his other books. He describes TV and magnetic recording basics as they apply to VCR's. Descriptions include many examples of the special tools and fixtures required for service of each VCR model.

Electronics and mechanical theory, complete for both Beta and VHS, applies to practical service applications: input, output, test point, adjustment controls, typical signals, etc. There are many clear schematics.

CIRCLE 121 ON FREE INFORMATION CARD

TRS-80 MODELS I, III, & COLOR COMPUTER INTERFACING PROJECTS, by William Barden, Jr. Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268; 272 pp, 5 1/4 x 8 1/2 inches, softcover, \$14.95.

This book shows how the Radio Shack TRS-80 models I and III computers, and the Color Computer, can be interfaced easily and inexpensively to "real world" devices such as telephones, audio inputs, temperature- and pressure-sensors, clock timers, and wind-speed instruments. Some of the projects described require implementation of some special-purpose hardware that connects to the computer input/output ports; but in other projects, no special hardware will be required, because the computers' systems themselves provide everything that will be needed.

Many of the projects can be assembled with two or three integrated circuits, mounted on a simple project board. The projects described include voice input and synthesizers, light detectors, thermometers, pressure sensor, musical note generator, anemometer (for measuring wind speed), tachometer "wand," serial-out driver for cassette port, data-communications plugboard, half-year clock, and joysticks for model I and model III.

There are many diagrams and charts, and step-by-step instructions are provided for each project—the list of them is far longer than what has been mentioned above.

CIRCLE 122 ON FREE INFORMATION CARD

34 NEW ELECTRONIC PROJECTS FOR MODEL RAILROADERS, by Peter J. Thorne; Kalmbach Publishing Co., 1027 North Seventh Street, Milwaukee, WI 53233; 80 pp; 8 1/4 x 11 1/4 inches, softcover; \$10.95.

Despite the low number of pages, this is a big book, containing more than 225 photos and drawings, many in color. Each project includes an explanation of its circuitry, step-by-step wiring instructions, schematic diagrams, printed-circuit patterns, and, where applicable, trouble-shooting information.

The object of the book is to introduce model railroaders to new circuits and other electronics devices that can add to the enjoyment of their hobby. Each project has been fully tested and uses readily available components, such as integrated circuits and optoelectronic devices to simplify construction and ensure reliable operation.

The projects include throttles, sound and lighting devices, and signalling systems. There is also information about radio control, computers, and command-control systems such as the CTC-16 and Hornby Zero 1. The book has been designed so that even inexperienced hobbyists will be able to construct some of the projects, while the complicated projects will challenge those with electronics experience.

CIRCLE 123 ON FREE INFORMATION CARD

THE CB PLL DATA BOOK (International Edition), by Lou Franklin; CB City International, PO Box 31500, Phoenix, AZ 85046; 108 pp; 7 x 10 inches; softcover; \$14.95.

Here is a thorough international reference guide to CB PLL circuits for both the layman and professional serviceman. The emphasis is on how the PLL provides signal mixing and channel generation, and how it can be modified for such things as CB-to-Ham band conversions. The book includes non-technical discussions of binary, BCD, and ROM channel programming. There is pinout data of nearly every PLL device ever used, as well as data on radio models using the device.

CIRCLE 124 ON FREE INFORMATION CARD

THE TIMEX-SINCLAIR 1983 DIRECTORY, E. Arthur Brown Company, 1702 Oak Knoll Drive, Alexandria, MN 56308; 90 pages; 8 1/2 x 5 1/2 inches; softcover; \$5.00.

Here is a book that lists, describes, and provides photographs of the available peripherals and software for the TIMEX-Sinclair computer.

The directory covers such topics as: Where to find disk drives, RAM extensions, printers, modems, keyboards, interfaces, books, periodicals, programming aids, etc. It describes special applications like control circuitry, enhanced graphics, voice generation, music synthesis, video inversion, light pens, joysticks, etc. The software section includes everything from spreadsheets, word processors, data banks, engineering and design, to arcade and adventure games.

CIRCLE 125 ON FREE INFORMATION CARD

MODERN ELECTRONIC COMMUNICATION (second edition), by Gary M. Miller; Prentice-Hall, Inc., Englewood Cliffs, NJ 07632; 578 pp including index; 9 1/2 x 7 1/4 inches; hardcover; \$26.95.

So much has happened in the electronics field since 1978, when the first edition of this book was published, that a new edition was needed.

This new edition includes new sections that are devoted to LC circuit basics and oscillators; major updating to the digital communications material, and greatly expanded coverage of fiber optic communications. Those elements account for major revisions and expansions in chapters 1, 9, and 13. But every other chapter has also been revised and improved.

There are also more end-of-chapter problems of a quantitative nature, and problems in that category have been added and integrated in all chapters throughout the book.

After a chapter of introductory topics, covering noise, LC circuits, and oscillators, the following subjects are discussed in detail: amplitude modulation: transmission; amplitude modulation: reception; single-side-band communications; frequency modulation: transmission; frequency modulation: reception; television; communications techniques; digital communications; transmission lines, wave propagation, antennas; waveguides, radar, fiber optics, and microwaves and lasers. There are also many photos, charts, and diagrams.

CIRCLE 126 ON FREE INFORMATION CARD

NETWORK SYNTHESIS, by Charles A. Vergers; TAB Books, Inc., Blue Ridge Summit, PA 17214; 231 pages, including index; 8 1/4 x 5 inches; softcover, \$7.95.

Informally written, this handbook treats the subject of network synthesis thoroughly, beginning with a comparison of analysis and synthesis. That is followed by a series of basic synthesis problems and a discussion of transfer functions. The author deals with the problem of recognizing transfer functions from their equations as well as frequency response. When that is mastered, the reader is ready to learn the procedures for impedance and frequency scaling.

The Butterworth and Chebyshev lowpass-filter derivation is explained, and the reader will learn the procedure for evaluating impedance and admittance equations. And for those situations where a filter-induced loss is not acceptable, there's a section showing how to synthesize active networks.

This book is profusely illustrated, and various experiments are included at the end to help the reader get hands-on experience at a comfortable pace; the experiments can be performed with a minimum of equipment. **R-E**
CIRCLE 127 ON FREE INFORMATION CARD

BETA Electronics

1700 E. DESERT INN RD., SUITE 222 LAS VEGAS, NEV. 89109

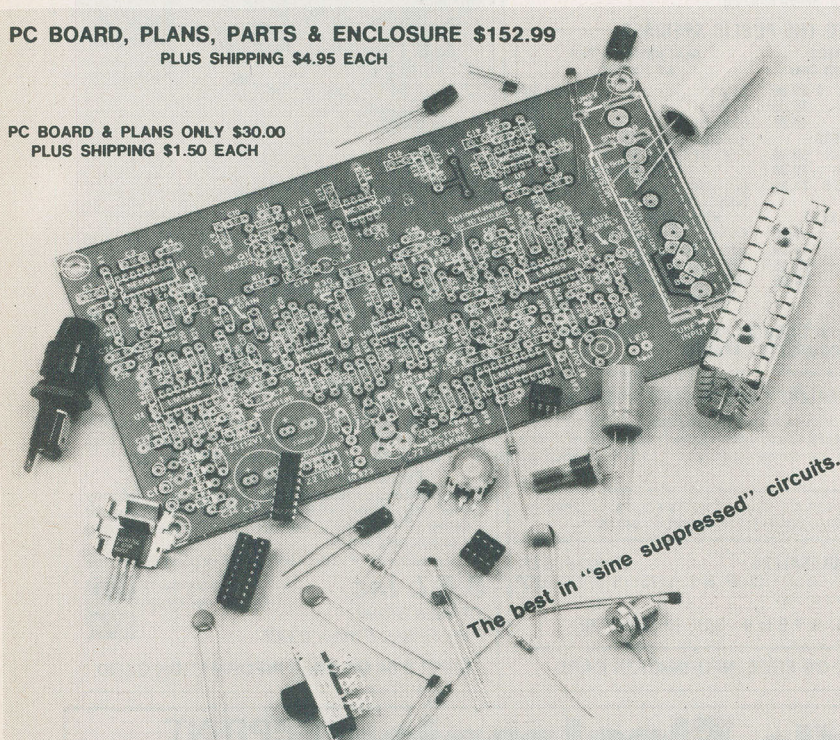
TOLL FREE 800 - 782-2701

"LEADER IN THE BEST
VIDEO CIRCUITS FOR THE
EXPERIMENTERS."

"The Deluxe II"

PC BOARD, PLANS, PARTS & ENCLOSURE \$152.99
PLUS SHIPPING \$4.95 EACH

PC BOARD & PLANS ONLY \$30.00
PLUS SHIPPING \$1.50 EACH



The best in "sine suppressed" circuits.

The ultimate in UHF sine wave converter technology with modulated audio.
Easy to build with fully illustrated plans. Outstanding video clarity and stability.

UHF AMPLIFIER KIT

PC BOARD, PLANS & PARTS \$19.99
PLUS SHIPPING \$1.50 EACH

EASY TO BUILD & NO SPECIAL EQUIPMENT REQUIRED.
IMPROVES RECEPTION WITH 12db GAIN.

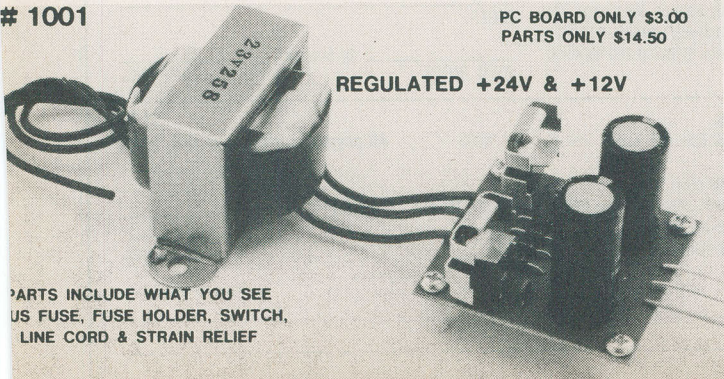
DUAL POWER SUPPLY

PC BOARD, PLANS & PARTS \$17.50
PLUS SHIPPING \$2.50 EACH

1001

PC BOARD ONLY \$3.00
PARTS ONLY \$14.50

REGULATED +24V & +12V



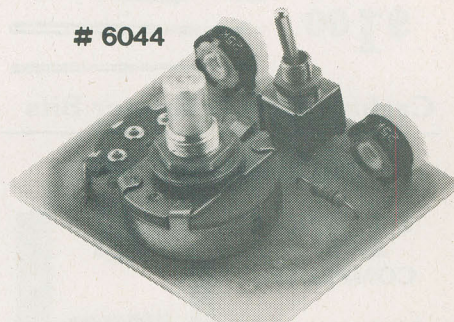
PARTS INCLUDE WHAT YOU SEE
US FUSE, FUSE HOLDER, SWITCH,
LINE CORD & STRAIN RELIEF

WORKS GREAT WITH THE "Z BOARD," "FV4" OR "FV5"

TWO CHANNEL SELECTOR SWITCH

PC BOARD, PLANS & PARTS \$5.95
PLUS SHIPPING \$1.50 EACH

6044



FITS DIRECTLY INTO YOUR DELUXE II
FOR CONVENIENT CHANNEL SELECTION.

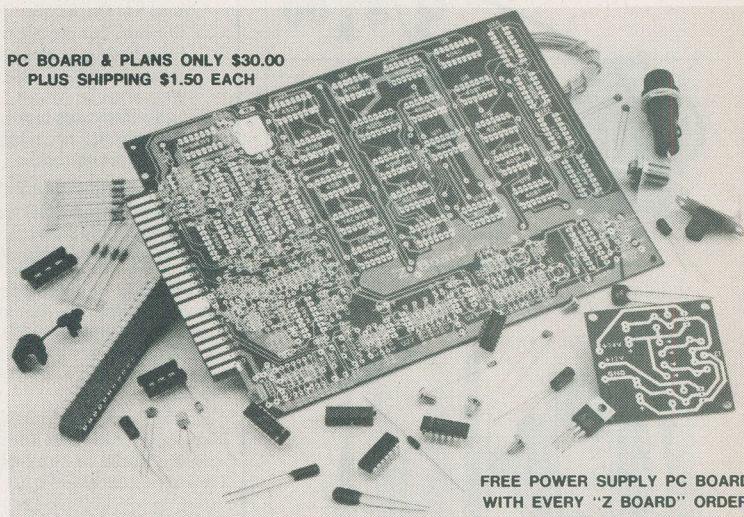
SPECIAL

NE 564 SUBSTITUTE CIRCUITS AVAILABLE
(PLUGS DIRECTLY INTO THE NE 564 POSITION)
\$4.95 EACH PLUS \$1.50 SHIPPING.

"THE Z BOARD"

PC BOARD, PLANS, PARTS & ENCLOSURE \$119.95
PLUS SHIPPING \$4.95 EACH

PC BOARD & PLANS ONLY \$30.00
PLUS SHIPPING \$1.50 EACH



FREE POWER SUPPLY PC BOARD
WITH EVERY "Z BOARD" ORDER

A powerful circuit with a challenge.

The best in UHF "pulse suppressed" circuits.
Suppressed horizontal synchronization with video inversion and
modulated audio that mates with your Zenith M1 module.
Fully illustrated plans for easy assembly.

QUANTITY DISCOUNTS AVAILABLE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CALIF. ORDERS ADD 6% SALES TAX

VISA/MST MONEY ORDERS NO PERSONAL CHECKS

CIRCLE 67 ON FREE INFORMATION CARD

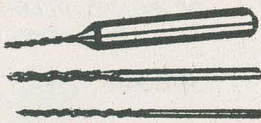
(602) 971-0990 (602) 971-0996

ARIZONA ELECTRONIC
SURPLUS
Wholesale - Retail - Surplus
Electronic Parts
12627 N. Cave Creek Rd. • Phoenix, AZ 85022



**HOT
PLATES**
\$150

\$100

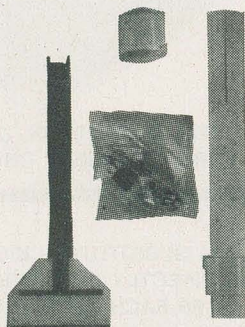


Carbide Drill & Router Bits

MICROWAVE KIT

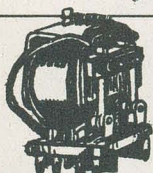
**\$14⁹⁵
COMPLETE**

- P.V.C.
- PC Board
- 2 - 2SC2369
- 1 - MRF911
- Resistors
- Capacitors
- "F" Connector
- Chip Cap



**10" FIBERGLASS
SCREW DRIVER**
with Plastic Handle

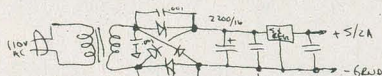
3/\$100



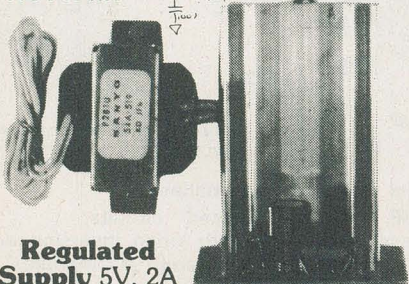
Latching Relay

\$4⁹⁵

24V Coil
110V @ 15A D.P.S.T.



NOT A KIT



**Regulated
Supply 5V, 2A**
w/Transformer and 4" x 2.3" Heat Sink
\$5.50 each -or- 2/\$10.00



Items MC, VISA, COD via UPS
(Plus Shipping/Handling)



CIRCLE 89 ON FREE INFORMATION CARD

CABLE TV EQUIPMENT

JERROLD - OAK - HAMMLIN



- Table Top
- Remote Control
- 60 Channel Wireless

SEND OR CALL FOR INFORMATION

The unauthorized use of Cable TV equipment may be illegal, check with your local Cable Co. before ordering.

TO THE PUBLIC SPECIALS

CAR STEREOS		AKAI HOME STEREO	
AM FM IN Dash Cass.		AM FM Rec.	
AUDIOVOX 600	\$ 65.00	30 Watt	\$ 183.00
CLARION 3100	86.00	45 Watt	241.00
Imported ELITE	49.00	60 Watt	314.00
EQUALIZERS		TURN TABLES	
10 BAND 150 Watt	59.00	B DOLBY Cass. Deck	135.00
7 BAND 150 Watt	49.00	C DOLBY Cass. Deck	150.00
CLARION 500 EQ B	71.00	BELT DRIVE	
6 X 9 TRIAXIALS		DIRECT DRIVE	98.00
AUDIOVOX	29.00	HOME STEREO SPEAKERS	
CLARION	78.00	PIONEER 100 Watt 4 way	159.00
JENSEN II	60.95	with 12" WOOFER	PR.
Imported	24.95	JVC 100 Watt 4 way	169.00
		with 12" WOOFER	PR.
		EGO 85 Watt 3 way	219.00
			PR.

Orders sent UPS COD OR PREPAID. CREDIT CARD.
SEND FOR COMPLETE CATALOG.

WANTED: DEALERS • WHOLESALERS • PEDDLERS

Become a CABLE TV giant in your town and get in on the big profits. send or call for **DEALER** catalog information with special Dealer Pricing. Limited Territories. car stereos AUDIOVOX. CLARION. JENSEN and major imports

KEEP US IN MIND FOR ALL YOUR CABLE TV EQUIPMENT REPAIRS
SYSTEMS COMPLETELY REBUILT - \$45.95

L.I. PUBLIC WHOLESALERS (516) 581-7232
2701 SLIP AVENUE (Rt. 111) ISLIP, N.Y. 11751 (516) 277-4232
(500 Ft. So. of Sunrise Hwy.)

HOURS: M-F 9 to 9 - SAT. 10:30 to 7:30

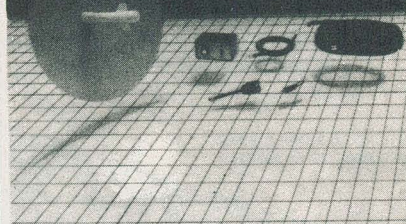
CIRCLE 44 ON FREE INFORMATION CARD

SKYFOX

State-of-the-Art Excellence

SKYFOX DESIGN PERFORMANCE FEATURES:

- Gain 55 db • Frequency 1.9-2.5 GHz
- Range 55 miles maximum • Tuning channels 2-6
- 20 inch Parabolic dish antenna • 60 ft. cable
- Cable adapters, mounting brackets and hardware included
- Illustrated instructions



Receive movies, special presentations and educational broadcasts — **ALL FREE** — with the SKYFOX deep fringe microwave receiver for homeowners outside the service area of microwave TV stations. SKYFOX receives up to a distance of 55 miles. From microwave transmitters located on buildings or towers in almost all medium and large size cities. SKYFOX does not receive Cable TV or satellite transmissions.

SKYFOX I \$ 79.95 (not pictured, 25 mile line of site)
SKYFOX II \$109.95 (as shown, 55 mile line of site)

ORDERS ONLY: Toll Free 1-800-323-1327

For Information Call: 1-312/564-0104

Visa, Mastercharge accepted, COD, cash or Money Order only. When ordering by mail, Money Orders or Cashiers Checks only. Personal checks, wait 4 weeks for check clearance.

90 day warranty • Conditional money back guarantee

S.E.I. Inc.

10 Main Street
Park Ridge, Illinois 60068

Available by
Mail Order Only



CIRCLE 64 ON FREE INFORMATION CARD

Radio-Electronics REPRINT BOOKSTORE

- ☐ Build Your Own Satellite TV Receiver \$7.00
- ☐ 8-Ball Satellite TV Antenna \$5.00
- ☐ Build Your Own Robot \$12.00
- ☐ TV Descrambler (January, February 1981) \$3.00
- ☐ Radio-Electronics back issues (1983) \$3.00
(January, February 1983 not available)
Write in issues desired.
- ☐ Radio-Electronics back issues (1982) \$3.50
(January 1982 not available)
Write in issues desired.
- ☐ Radio-Electronics back issues (1981) \$4.00
(March, December 1981 not available)
Write in issues desired.
- ☐ Etch your own PC Boards \$3.00

To order any of the items indicated above, check off the ones you want. Complete the order form below, include your payment, check or money order (DO NOT SEND CASH), and mail to Radio-Electronics, Reprint Department, 200 Park Ave. South, New York, NY 10003. Please allow 4-6 weeks for delivery.

If you need a copy of an article that is in an issue we indicate is unavailable you can order it directly from us. We charge 50¢ per page. Indicate the issue (month & year), pages and article desired. Include payment in full, plus shipping and handling charge.

- ☐ Special Projects (Spring 1981) \$4.50
- ☐ Special Projects #4 (Summer 1982) \$4.50
- ☐ Special Projects #5 (Winter 1983) \$4.00
- ☐ Special Projects #6 (Spring 1983) \$3.50
- ☐ Special Projects #8 (Winter 83) \$3.00
- ☐ Radio-Electronics Annual 1983 \$3.50
- ☐ Radio-Electronics Annual 1984 \$2.50
- ☐ Radio-Electronics Annual \$2.50
- ☐ How to Make PC Boards \$2.00
- ☐ All About Kits \$2.00
- ☐ Modern Electrics (Vol. 1. #1, April 1908) \$2.25
- ☐ Electro Importing Co. Catalog \$4.95
(1918) (176 pp)

ARTICLE

MONTH

YEAR

PAGES

TOTAL PAGES

@ 50¢ each

TOTAL PRICE

MAIL TO: **Radio-Electronics**

Reprint Department, 200 Park Ave. South, New York, NY 10003

11-83

All payments must be in U.S. funds

Total price of order \$
Sales Tax (New York State Residents only) \$
Shipping & Handling (U.S. & Canada only) (Includes FIRST CLASS POSTAGE) \$1.00 per item \$
All other (\$2.00 per item, sea mail) \$
(\$4.00 per item, air mail) \$

Total Enclosed \$

Name

Address

City

State

Zip



SEI, INC.

641 Academy Drive • Northbrook, Ill. 60062 • (312) 564-0104



THE SOLUTION COMPUTER

An Affordable 64K Assembled Computer With These Features:

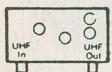


- Fully compatible with Apple® II +
- Original design!
- Fully assembled and tested!
- Detachable keyboard for easy use, upper lower case.
- Uses 64K × Dynamic Ram
- 9 on board peripheral connectors for expansion.
- Uses 6502 mpu.

\$675.00 each (Monitor not included)

The Solution Computer is the answer for people who realize a great product when they see one. Many other peripheral card products are available for the Solution Computer. Send for a free color brochure today.

UHF TV PREAMP



Features:

- 25 dB gain!
- Kit

Your reception will dramatically improve! This unit will enable you to pull in signals you never knew were there!

For both indoor and outdoor use. Input and output impedance 75 ohm. No adjustment! Easy assembly.

JH-0 Kit..... \$23.95

R.F. MODULATOR



Combine both audio and video output onto channel 3 or 4 of your T.V. set. Single J.C. chip (MC 1374) makes for quick and easy assembly. Single adjustment control! A must for every video recording or computer enthusiast.

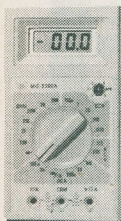
VH-0 Kit..... \$19.95

PHILIPS VARACTOR TUNER

Comes with adaptor board to directly replace Mitsumi tuner! Can use this with any board drilled for Mitsumi! High gain and phenomenal picture quality.

SPECIFICATIONS: • Freq. Range: 470-899 mHz • Output: Channel: 3 • Input: 75 ohm • Gain: 18 dB

ELC 1045..... \$23.95



DIGITAL MULTIMETER

- 3 1/2 digit LCD meter
- Input impedance 20 Ohm
- hFE measurement
- DC .5% accuracy
- DCA up to 10 amps
- Leads and battery included

MIC-3300A..... \$59.95
Carrying Case..... \$ 9.95

TTL/CMOS LOGIC PROBE

- 4 LED states
- Pulse memory
- Supply Voltage 3 ~ 18 VDC
- TTL CMOS checking made easy!

L101A..... \$34.95

LOGIC PULSAR PROBE

- Easily repair logic circuits
- .5Hz or 500Hz signal
- External Sync Input
- Supply Voltage 3 ~ 18 VDC

L201A..... \$34.95

APPLE II® COMPATIBLE SLIM DISK DRIVE

RUNS QUIETER THAN THE ORIGINAL!

New - guaranteed! Only 6" w x 1 1/2" h x 10" d. Complete with a 3' cable. Runs with Apple controller or our optional controller.



Now only \$224.95

SOLID STATE STEREO GRAPHIC EQUALIZER PRE AMP KIT TA-2500



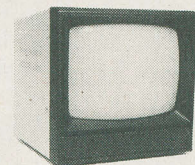
Specifications: • Total Harmonic Distortion: Less than 0.05% • Intermodulation Distortion: (70Hz: 7KHz = 4:1 SMPTE Method) Less than 0.03% • Frequency Response: Overall 10Hz ~ 100KHz +0.5db -1dB. • RIAA Curve Deviation: (Phono) +0.2dB -0.2dB (30Hz ~ 15KHz) • Channel separation (at rated output 1 KHz) • Phono. Tuner. Aux and Tape Monitor better than 70dB. • Input sensitivity and impedance (1KHz for rated output)

Phono: 2MV 47K ohms **Aux:** 130MV 50K ohms **Tuner:** 130MV 50K ohms **Tape:** 130MV 50K ohms. **Graphic Equalizer control:** 10 Band Slide Control. **Frequency Bands:** 31 5Hz: G3Hz: 125Hz: 250Hz: 500Hz: 1KHz: 2KHz: 4KHz: 8KHz: 16KHz also with on panel selector for Phono. Tuner. Aux 1 and Aux 2. **Power Supply:** 117 VAC

Kit comes with all electronic components, transformer, instructions and a 19" rack mount type metal cabinet.

MODEL TA-2500 \$119.00 PER KIT

MONITOR (12")



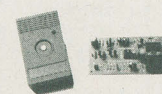
- Orange amber screen
 - 18 MHz bandwidth
 - High resolution graphics
- Composite video 1/0 75/10K ohm impedance. A phenomenal quality monitor for your computer. 110 VAC.

MON-1..... \$119.95

APPLE II PERIPHERAL CARDS

- 80 column card..... \$109.95
- 16 Ram card..... \$44.50
- Z80 cpm card..... \$99.95
- Disk controller card..... \$59.95
- Eprom writer card..... \$84.95

INFRA-RED REMOTE CONTROL SWITCH KIT



Infra-red Remote Control switch can be used to control appliances up to 500 W. The TK-41 has effective control up to 10 meters.

No antenna needed. Features latest IC controller which excludes interferences from light or AC pulse signal.

TK-41 Kit..... \$24.95

FOR INFORMATION CALL (312) 564-0104

TO ORDER OUTSIDE ILLINOIS:

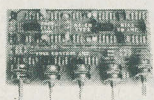
CALL TOLL FREE 1-800-323-1327

LOW TIM DC STEREO PRE-AMP KIT TA 2800

Incorporates state of D.C. design that gives a frequency response from 0Hz-100KHz ± .5dB. • Features tone defeat switch, loudness, treble, midrange, bass, balance. • TA-2800 contains quad BiFet op-amp to develop T.H.D. of .005% at rated output • Input sensitivity: phone 2.5 MV tuner, aux, tape play 100MV/100K • Power supply ± 15 volt DC at .2A. Kit comes with regulated power supply, all you need is a 15-20 VCT .2 amp. XFMR.

Only \$44.50

XFMR \$4.50 ea.



AMATEUR MICROWAVE RECEIVER KIT 1.9-2.5 GHZ

PS-1 Assembled 32 element antenna \$19.95
PS-2 20 dB gain microwave receiver kit with variable power supply kit..... \$50.00

PS-3 Complete package PS-1 & 2... \$65.00

MOUNTING HARDWARE INCLUDED

NEW KIT

MICROWAVE PREAMP!

Use with PS-3 Kit. Adds 20-25 dB gain to boost reception distance.

• Low Noise

• High Gain

• Can be used with all existing stop sign board receivers!

• 1.9-2.5 GHz freq. range

PS-4 (Kit)..... \$34.95

SOLID STATE STEREO REVERBERATION AMPLIFIER



Specifications:

- Total harmonic distortion less than .05%
- Frequency response 10 Hz to 50KHz ±1dB
- S/N Ratio 90dB
- Reverberation time 1 to 3 sec
- Input 150MV/50K ohm
- Max. input 2V
- Accepts input from tape, phono, or aux.

Includes an LED Reverb Level display. Kit comes with all electronic components, transformer and instructions, and 19" rack mount cabinet.

Model TA-2400..... \$89.95

SPY EAR!

A very popular device designed to listen to sounds & voices through rooms or 3 ft. thick concrete walls. Place listening sensor against wall and earphone in ear. Adjust volume control! Hear clearly to things you might not want to!



CM-8..... \$89.95

TY-45 20 STEP LED POWER LEVEL INDICATOR KIT

This new stereo level indicator kit consists of 40 3-color LED's to indicate sound level output of your amplifier from -57 dB to 0 dB. Comes with an attractive silk screen printed panel. Has selector switch to allow floating or gradual output indicating.

Kit includes all parts, Front panel and power supply.

TY-45 KIT

\$34.95



MICRO COMPUTER POWER SUPPLY TR-626

The TR-626 is a power regulator for use with popular microcomputer circuits. Features:

- ±5V 6A
- -5V .5A
- +12V 1.5A
- -12V .5A



Each unit contains current limit protect circuit and two Darlington power transistor on a heatsink. Transformers included.

\$39.95 each

Minimum order \$15.00. Add 10% shipping on orders under \$35.00. Orders over \$35.00, add 5%. Catalog - \$1.00. Visa & Mastercharge acceptable.

CIRCLE 55 ON FREE INFORMATION CARD



POPULAR TELEVISION CIRCUITS

Miste SATELLITE TELEVISION RECEIVER

\$349.95

SATELLITE TELEVISION

\$349.95

- * 6' FIBERGLASS DISH
- * POLAR MOUNT AND FEED

SINE WAVE

- * Fully Illustrated Instructions
- * NO Internal Connection to T.V.
- * Continuous Audio/Video Modulation
- * AGC FOR STABILITY
- * Quality Circuit Board
- * Silk Screened Parts Layout

- ☐ P.C. Board and Plans \$20.00 + \$3.00 Shipping and Handling
- ☐ All Parts and Wood Grained Cabinet \$99.95 + \$5.95 Shipping and Handling
- ☐ P.C. Board, Plans, All Parts and Wood Grained Cabinet \$119.95 + \$5.95 Shipping and Handling

* AVAILABLE BY MAIL ORDER ONLY

* COMPLETE REPAIR SERVICE * HOBBY USE ONLY, NOT FOR UNAUTHORIZED RECEPTION OF T.V. SIGNALS

* SEND FOR INFORMATION ON OTHER KITS



INFO
PHONE:

WESTECH ELECTRONICS

(602) 829-6700

CREDIT FUNDS AND MONEY ORDERS
SHIPPED IMMEDIATELY
PERSONAL CHECKS HELD FOR 3 WEEKS
FOR CLEARANCE
MASTERCARD, VISA, UPS, C.O.D.



WESTECH
ELECTRONICS

ORDERS
ONLY:

(800) 243-6700

CIRCLE 13 ON FREE INFORMATION CARD

PANASONIC RF MODULATORS

ENC 16505 crystal controlled

BRAND
NEW! \$24.95

VIDEO TAPE RECORDERS, SATELLITE TV RECEIVERS
FOR BRILLIANT PICTURES ON CHANNEL 3 OR 4



FV-5
Phase Video
Sync. Suppression
M1 & FV-5 used as a system
ZENITH M1
09-151-03

- ☐ FV-5 Board and Plans \$30.00 + \$3.00 Shipping and Handling
- ☐ FV-5 PCB, Plans and Parts \$149.95 + \$6.95 Shipping and Handling
- ☐ M1, FV-5 PCB, Plans, Parts, Woodgrain Cabinet \$189.95 + \$6.95 Shipping and Handling

MICROWAVE PROBE KIT

- * P.C. Board
 - * Microwave Transistors
 - * All Parts and Plastic Housing
- \$24.95**
+ \$3.00 Shipping & Handling

POWER SUPPLY COMPLETE KIT

\$19.95
+ \$3.00 Shipping & Handling



Send for our FREE 1984 catalog of electronic components, kits, IC's, computer software, computer peripherals and unique items.

PARTS SUPER SPECIALS!

TRANSFORMERS

24V 1 amp \$3.50
24V CT 1 amp \$4.50

EPROMS

1702 \$3.60
2732 \$3.85

TI Infrared Sensor 50¢ ea.
TI Mini Red LED 12¢ ea.
2N3906 PNP TO92 8¢ ea., 100/6.00
C103BI 200V .8 AMP SCR 35¢ ea.
C106BI 200V 4 AMP SCR 79¢ ea.
MM5309 Clock IC 1.50 ea.
MM5314 Clock IC 1.50 ea.
MM5369 60 HZ IC 1.50 ea.
Carbide Drill Bits #55, 56, 58
59, 61, 63 Your Choice. 1.29 ea.

VISIT OUR NEW RETAIL STORE

LOCATED AT 3101 W. HAMPDEN, ENGLEWOOD, CO 80110

Phone 781-1589

12VDC ALARM HORN

Extra Loud Metal Horn
69¢

120VAC STROBE KIT

Complete variable rate strobe light kit. Contains all parts, PC board, line cord and instructions.
\$9.95

ULTRASONIC TRANSDUCER

Great for making bug chasers, alarms, etc.
\$2.50 ea.

2x3 ZIP CLOSE BAGS

Perfect for packaging small components.
50 for 2.50

CHANEY
electronics inc.

Phone Orders
303-781-5750

Minimum AD Order \$9.00
Please include \$1.50 for postage (UPS)
VISA, MC accepted
Phone orders are welcome

Send for our free catalog of unique items

P.O. BOX 27038
DENVER, COLORADO 80227
303-781-5750

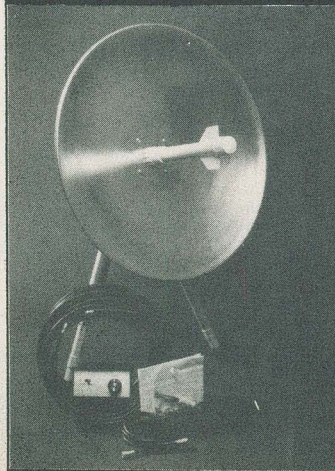
CIRCLE 34 ON FREE INFORMATION CARD

MICROWAVE TV ANTENNA SYSTEMS

Freq. 2.1 to 2.6 GHz • 34 db Gain +



TWO YEAR WARRANTY
PARTS & LABOR



COMPLETE SYSTEMS (as Pictured)

Commercial 40"
Rod Style \$ 89.95
Parabolic 20"
Dish Style \$ 79.95

COMPONENTS

Down Converters
(both types) \$ 34.95
Power Supplies
(12V to 16V) \$ 24.95
Data Info (Plans) \$ 9.95

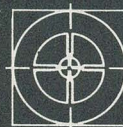
CALL OR WRITE FOR
KITS, PARTS, INDIVIDUAL
COMPONENTS

We Repair All Types Down
Converters & Power Supplies

**Phillips-Tech
Electronics**

P.O. Box 34772
Phoenix, AZ 85067
(602) 265-8255

Special Quantity Pricing
Dealers Wanted

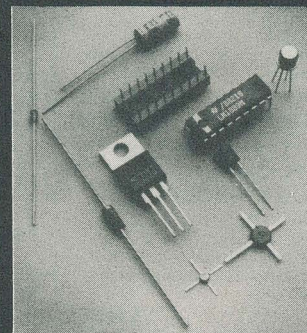


KCS ELECTRONICS CORPORATION

SEMICONDUCTOR PARTS & PRODUCTS

FACTORY PRIME DEVICES INCLUDE:

- Capacitors
all types & styles
- Chokes & Coils
- Connectors
- Digital & Linear IC's
- Hardware & Accessories
- IC Sockets
- Memory
- Microwave Semiconductors
- Resistors
fixed & variable
- Transformers
- Transistors & MORE!



MANUFACTURERS SUCH AS: Motorola, National, NEC,
J.W. Miller, Texas Instruments and more!

WE STOCK & SUPPLY DEVICES FOR: OEM's,
Distributors, Hobbyists, Magazine Projects, Engineers,
Schools, Technicians & You!

Call or Write for Quantity Pricing
and FREE Catalog.

P.O. Box 33205
Phoenix, AZ 85067

(602) 274-2885

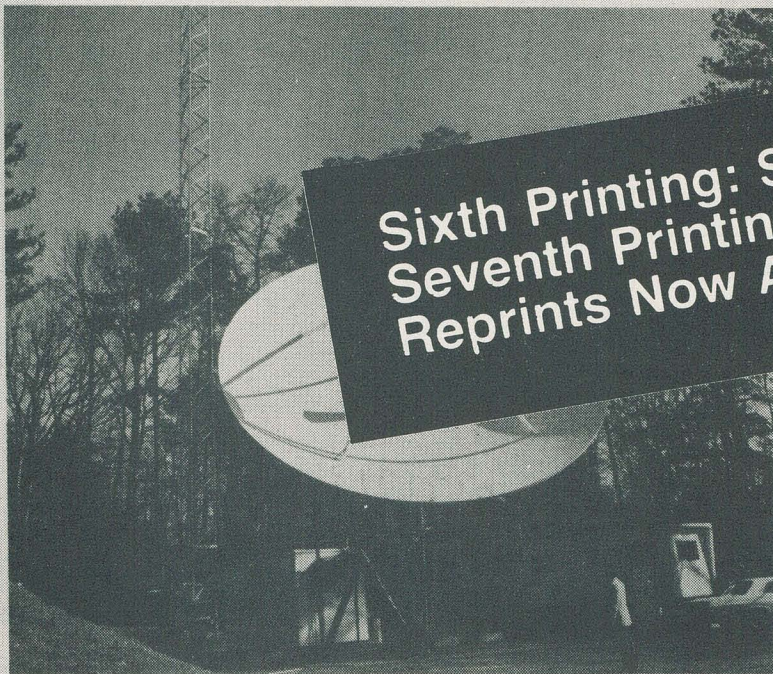
CIRCLE 83 ON FREE INFORMATION CARD

CIRCLE 29 ON FREE INFORMATION CARD

Radio-Electronics®

Copyright © Gernsback Publications Inc., 1980

SPECIAL REPRINT BUILD A BACKYARD SATELLITE TV RECEIVER



**Sixth Printing: Sold Out!
Seventh Printing—Just Off Press!
Reprints Now Available!**

Don't miss out again!

Send away today for your 36-page booklet containing a complete reprint of all seven articles in the series on Backyard Satellite TV Receivers by Robert B. Cooper Jr.

This all-inclusive report gives you all the data you need to build your own Backyard Satellite TV Receiver.

■ TELLS ALL ABOUT domestic satellite communications, with full details on how you can pull those elusive TV signals from space.

■ LEGAL REQUIREMENTS, technical specifications, and how you, the

home constructor, can meet them. Find out what mechanical and electronics skills you need.

■ RECEIVER CHARACTERISTICS, technical details and specifications, along with examples of actual receivers built at comparatively low cost.

■ ANTENNA DESIGN... and exactly how you can build a spherical antenna, while keeping total earth-station cost for the complete system under \$1,000.

■ THE FRONT-END is critical when you build your own system. We help you explore several different ap-

proaches to making one that will work for you.

■ RECEIVER-SYSTEM hardware, and how it goes together to bring you direct-from-satellite TV reception in your own home.

To order your copy:

Complete coupon and enclose it with your check or money order for \$7.00, plus \$1.00 for postage and handling. We will ship your reprint within 6 weeks of receipt of your order. All others add \$4.00 for postage. New York State residents must add 58¢ sales tax.

Radio-Electronics

Satellite TV Reprints
45 East 17th Street
New York, N.Y. 10003

Please print

RE 11-83

(Name)

(Street address)

(City)

(State)

(Zip)

I want _____ reprints @ \$7.00 each, plus \$1. Handling & Postage.
I have enclosed \$ _____. N.Y. State residents must add sales tax.

CIRCUIT SPECIALISTS

YOUR SEMICONDUCTOR
SUPERMARKET

74LS00 SALE

74LS00	.20	74LS123	.50	74LS249	1.25
74LS01	.24	74LS125A	.50	74LS251	.60
74LS02	.24	74LS126A	.50	74LS253	.60
74LS03	.24	74LS132	.80	74LS256	1.50
74LS05	.24	74LS133	.80	74LS257A	.60
74LS08	.24	74LS136	.40	74LS258A	.60
74LS09	.24	74LS137	1.00	74LS259	1.25
74LS10	.24	74LS138	.80	74LS260	.55
74LS11	.24	74LS139	.80	74LS266	.55
74LS12	.24	74LS145	1.30	74LS273	1.25
74LS13		74LS147	1.65	74LS279	.55
		74LS148	1.65	74LS280	2.25
74LS14	.45	74LS151	.55	74LS283	.90
74LS15	.32	74LS155	.55	74LS290	.80
74LS20	.32	74LS156	.80	74LS293	.90
74LS21	.32	74LS157	.80	74LS295A	.95
74LS22	.32	74LS158	.80	74LS298	.90
74LS26	.32	74LS160A	.85	74LS299	2.60
74LS27	.32	74LS161	.85	74LS322A	4.60
74LS28	.32	74LS162	.80	74LS323	4.60
74LS30	.32	74LS163A	.80	74LS348	1.75
74LS32	.32	74LS164	.80	74LS352	1.25
74LS33	.32	74LS165	1.25	74LS353	1.25
74LS37	.40	74LS166	1.25	74LS365A	.55
74LS40	.35	74LS168	1.25	74LS366A	.55
74LS42	.60	74LS169	1.25	74LS367A	.55
74LS47	.89	74LS170	1.75	74LS368A	.55
74LS48	1.00	74LS173	.80	74LS373	1.35
74LS49	1.00	74LS174	.55	74LS374	1.25
74LS51	.29	74LS175	.60	74LS375	.55
74LS54	.29	74LS181	2.25	74LS377	1.25
74LS55	.29	74LS182	1.25	74LS378	1.25
74LS73A	.42	74LS183	2.75	74LS379	1.25
74LS74A	.42	74LS190	.85	74LS385	3.50
74LS75	.45	74LS191	.85	74LS386	.55
74LS76A	.45	74LS192	.85	74LS390	1.25
74LS77	.70	74LS193	.85	74LS393	1.25
74LS78A	.49	74LS194A	.80	74LS395	1.25
74LS83A	.75	74LS195A	.80	74LS398	2.25
74LS85	.90	74LS196	1.00	74LS399	1.25
74LS86	.45	74LS197	1.00	74LS490	2.10
74LS90	.45	74LS221	1.25	74LS540	2.10
74LS91	1.10	74LS240	1.25	74LS541	2.10
74LS92	.55	74LS242	1.25	74LS568	3.99
74LS93	.55	74LS243	1.25	74LS569	3.99
74LS95B	.65	74LS244	1.25	74LS620	2.00
74LS107A	.45	74LS245	1.75	74LS621	2.00
74LS109A	.45	74LS247	1.25	74LS622	2.00
74LS112A	.45	74LS248	1.25	74LS623	2.00
74LS113A	.45			74LS640	2.00
74LS114A	.60				
74LS122	.80				

7400

7400	.20	7475	.50
7401	.29	7476	.38
7402	.29	7485	1.10
7403	.29	7486	.35
7404	.31	7489	2.40
7405	.32	7490	.52
7406	.38	7492	.52
7408	.31	7493	.52
7410	.30	7495	.67
7411	.46	7496	.73
7413	.31	74107	.35
7414	.59	74121	.40
7417	.32	74123	.58
7420	.29	74125	.52
7425	.31	74145	.75
7427	.32	74147	1.67
7430	.30	74151	.87
7432	.31	74153	.75
7438	.31	74154	1.17
7440	.29	74164	1.05
7441	1.00	74165	1.05
7442	.83	74174	1.00
7446	.83	74175	.83
7447	.83	74176	.80
7448	.83	74177	.80
7450	.29	74190	1.08
7472	.35	74192	.99
7473	.35	74193	.99
7474	.35	74196	.80

LINEAR IC'S

LM301AN	.48	LM3900	.75	MC1489P	1.10
LM307N	.56	LM3909	1.00	MC1496P	1.48
LM308N	.71	LM3911	1.50	MC1723P	.62
LM310N	2.40	LF347	2.35	MC1741CP1	.56
LM311N	.69	LF351	.60	MC3301	.90
LM318N	2.50	LF353	.99	MC3302	.80
LM319N	2.40	LF357	1.10	MC3401	.90
LM324N	.71	NE555	.42	MC3403P	1.30
LM325N	3.30	MC1306P	1.10	MC1648P	3.80
LM326N	3.30	MC1310	4.29	MC1658P	4.50
LM358N	.93	MC1330A1P	1.50	MC4024P	4.49
LM359N	.69	MC1349P	1.17	MC4044P	4.49
LM383T	2.30	MC1350P	.98	ICM7208	15.95
LM377N	2.40	MC1351P	1.70	ICM7207A	6.00
LM378N	3.15	MC1357P	1.49	ICM7217A	9.95
LM379N	4.60	MC1358P	1.30	ICM7205	12.95
LM380N	4.60	MC1372P	4.42	ICM7045	15.50
LM381N	2.25	MC1373P	3.54	ICL8038	3.40
LM381AN	3.60	MC1403U	2.71	ICM7555	1.20
LM384N	2.00	MC1405L	9.70	MWA110	7.45
LM386N	.99	MC1413P	1.20	MWA120	7.80
LM565N	1.35	MC1374P	2.61	MWA130	8.25
LM566N	2.30	MC1376P	2.08	MWA310	8.25
LM567N	1.35	MC1458CP1	.77	MWA320	8.65
LM1889	3.20	MC1488P	1.10	ZN414	2.00

CMOS

CD4001	.30	CD4046	1.50	MC14000	.40	MC14023	1.22
CD4007	.32	CD4047	1.40	MC14001	.40	MC14024	1.06
CD4010	.55	CD4049	.45	MC14002	.40	MC14024	.40
CD4011	.32	CD4050	.45	MC14006	1.42	MC14027	.72
CD4013	.45	CD4051	1.00	MC14007	.40	MC14028	1.02
CD4016	.50	CD4066	.65	MC14008	1.25	MC14032	1.93
CD4017	1.00	CD4069	.32	MC14012	.40	MC14034	3.50
CD4020	1.17	CD4070	.45	MC14013	.72	MC14035	1.86
CD4023	.32	CD4071	.32	MC14014	1.25	MC14038	2.19
CD4024	.83	CD4081	.32	MC14015	1.47	MC14040	1.47
CD4025	.32	CD4093	.60	MC14016	.72	MC14042	1.06
CD4027	.55	CD4510	1.17	MC14017	1.25	MC14043	.99
CD4029	1.42	CD4511	1.20	MC14018	1.15	MC14044	.99
CD4040	1.17	CD4515	2.80	MC14020	1.47	MC14046	1.57
CD4044	.80	CD4518	1.17	MC14021	1.25	MC14049	.72

MOST MOTOROLA CMOS IN STOCK

VOLT-REGS

7805	.80	LM317T	1.00
7806	.80	LM317K	3.75
7808	.80	LM323K	6.95
7812	.80	LM350T	3.25
7815	.80	LM350K	5.50
7818	.80	LM338K	7.60
7824	.80	LM337T	1.90
7905	1.30	78L05	.40
7906	1.30	78L12	.40
7908	1.30	78L15	.40
7912	1.30	79L05	.80
7915	1.30	79L12	.80
7918	1.30	79L15	.80
7924	1.30	78H05KC	9.25
		78H12KC	9.25

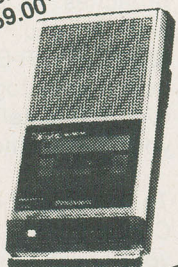
CIRCUIT SPECIALISTS INC.
738 S. Perry Lane, Tempe, AZ. 85281
Order Phone: 1-800-528-1417
INCLUDE \$1.25 SHIPPING

CIRCLE 45 ON FREE INFORMATION CARD

SUPER LONG PLAY TAPE RECORDERS

10 Hour Model — \$95.00*
14 Hour Model — \$159.00*

Modified Panasonic Slimline, high quality, AC-DC Recorders provide 5 or 7 continuous hours of quality recording & playback on each side of cassette for a total of 10 or 14 hours depending on model. Built-in features include: • Voice level control, • Digital counter, etc. TDK DC 180 Cassette Furnished.



PHONE RECORDING ADAPTER

Records calls automatically. All Solid state connects to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up. \$24.50* FCC APPROVED



VOX VOICE ACTIVATED CONTROL SWITCH
Solid state. Self contained. Adjustable sensitivity. Voices or other sounds automatically activate and control recorder. Uses either recorder or remote mike. \$24.95*
*Add for ship & hdlg. Phone Adapter & Vox \$1.50 ea. Recorders \$4.00 ea. Cal. Res. add tax. Mail order, VISA, M/C, COD's OK. Money Back Guarantee. Qty. disc. avail. Dealer inquiries invited. Free data.
AMC SALES INC. Dept 9335 Lubec St., Box 928, Downey, CA (213) 90421 Phone 869-8519

SEE YOUR DEALER TODAY

FROM



HERE'S A TIP
THAT'S PERFECT!

AM/FM AUTO RADIO
AND CB

'Firestik' II GOLDEN SERIES

BARE-HANDS TUNABLE
"NO TOOLS NEEDED"
HIGH PERFORMANCE ANTENNAS

ALSO ANTENNAS FOR
CORDLESS TELEPHONES
MONITOR SCANNERS

Dealer & Distributor Inquiries Invited
SEND FOR FREE CATALOG

'Firestik' Antenna Company
2614 East Adams/Phoenix, AZ 85034

Name _____
Street _____
City _____
State _____ Zip _____

Serving the CB and
Communications Market Since 1962.

5-YEAR REPLACEMENT WARRANTY

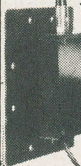
CIRCLE 40 ON FREE INFORMATION CARD

ACTIVE RECEIVING ANTENNA

Gives excellent reception,
50 KHz to 30 MHz.

New MFJ-1024 Active Receiving Antenna mounts outdoors away from electrical noise for maximum signal. Gives excellent reception of 50 KHz to 30 MHz signals. Equivalent to wire hundreds of feet long. Use any SWL, MW, BCB, VLF or Ham receiver.

High dynamic range RF amplifier. 54 in. whip. 50 foot coax. 20 dB attenuator prevents receiver overload. Switch between two receivers. Select auxiliary or active antenna. Gain control. "ON" LED. Remote unit, 3x2x4 in. Control, 6x2x5 in. 12 VDC or 110 VAC with optional adapter, MFJ-1312, \$9.95.



\$129.95
(+ \$4.00 shipping)

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping). One year unconditional guarantee. Order today. Call TOLL FREE 800-647-1800. Charge VISA, MC. Or mail check, money order. Write for free catalog. Over 100 products.

CALL TOLL FREE 800-647-1800

Call 601-323-5869 in Miss., outside continental USA, tech/order/repair info. TELEX 53-4590.

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

CIRCLE 66 ON FREE INFORMATION CARD



AMAZING DEVICES

PHASOR PAIN FIELD — Patented and recently developed in our labs is being tested by Gov't for riot control. Soon to come under weapons restrictions as an infirmal machine. Easily hand-held. Hazardous IF NOT USED WITH DISCRETION.
PPF-1 PLANS (sold for animal control) **\$15.00**
INVISIBLE PAIN FIELD GENERATOR — Produces a directional field of moderately intense pain to back of head up to 50". Cigarette pack size enclosure is easily hidden.
IPG-3 PLANS **\$7.00** **IPG-3K KIT & PLANS** **\$44.50**
IPG-30 (assembled for animal control) **\$59.50**
PHASOR STUN/BURNING WAND — Produces sufficient electrical energy capable of burning flesh. Intended as a personal defense device.
PSW-3 PLANS **\$8.00** **PSW-3K KIT & PLANS** **\$59.50**

RUBY LASER RAY PISTOL — Intense visible red, burns, hazardous, with parts sources.
RUBY PLANS (includes all part sources) **\$15.00**
CARBON DIOXIDE LASER — Generates 20-40 watts of continuous power capable of burning, cutting, hazardous. (with all part sources) **\$15.00**
LASER RIFLE — Produces 200-300 pulses of 30 watt optical energy. Portable and easily hand-held.
LRG-3 PLANS **\$10.00**
LRG-3K KIT PLANS (minus diode) **\$129.50**
POCKET LASER — For the beginner, visible red "optical version", non-hazardous.
LHC-2 **\$5.00** **LHC-2K KIT & PLANS** **\$24.50**
HIGH POWERED PORTABLE ENERGY SOURCE FOR LASERS AND MAGNETIC WEAPONS — Exploding wires, shockwave, etc. Miniature size.
HPS-1 PLANS **\$8.00** **HPS-1K KIT & PLANS** **\$49.50**
PARTICLE BEAM WEAPON — PLANS **\$15.00**

INFINITY XMTR — Uses telephone lines for selective home or office listening while away on business or vacation.
INF-1 PLANS **\$15.00**
SEE IN DARK — Long range, total darkness.
SD-4 PLANS **\$10.00**
LONG RANGE WIRELESS MIKE — Crystal clear quality miniature
FBT-7 PLANS **\$7.00** **FBT-7K PLANS & KIT** **\$34.50**
WIRELESS TELEPHONE TRANSMITTER — Long range, automatic.
VWPM-5 PLANS **\$10.00** **VWPM-5K PLANS & KIT** **\$34.50**

Send for **FREE** catalog description of above plus hundreds more plans, kits and completed items. We accept MC or Visa or when ordering, send check or money order. We pay shipping charges on orders over \$50.00, otherwise include 10% with remittance.

SEND TO: **SCIENTIFIC SYSTEMS**
 DEPT. R8, BOX 716, AMHERST, N.H. 03031

ELECTRONIC KITS FROM HAL-TRONIX

2304 MHZ DOWN CONVERTERS. TUNES IN ON CHANNELS 2 TO 7 ON YOUR OWN HOME T.V. HAS FREQUENCY RANGE FROM 2000 MHZ TO 2500 MHZ. EASY TO CONSTRUCT AND COMES COMPLETE WITH ALL PARTS INCLUDING A DIE-CAST ALUM CASE AND COAX FITTINGS. REQUIRE A VARIABLE POWER SUPPLY AND ANTENNA (Antenna can be a dish type or coffee can type depending on the signal strength in your area.)

2304 MOD 1 (Basic Kit) **\$19.95**
 (Less case & fittings)

2304 MOD 2 (Basic/Pre-amp) **\$29.95**
 (Less case & fittings)

2304 MOD 3 (Hi-Gain Pre-amp) **\$39.95**
 (Includes case & fittings)

POWER SUPPLY FOR EITHER MODEL ABOVE IS AVAILABLE. COMES COMPLETE WITH ALL PARTS, CASE, TRANSFORMER, ANTENNA SWITCH AND CONNECTORS
 (Kit) **\$24.95**
 Assembled **\$34.95**

Slotted Microwave Antenna For Above
 Downconverters **\$39.95**

PREAMPLIFIERS

HAL PA-19—1.5 mhz to 150 mhz, 19db gain operates on 8 to 18 volts at 10ma. Complete unit \$8.95.

HAL PA-14—3 mhz to 1.4 ghz, 10 to 12 db gain operates on 8 to 18 volts at 10 ma. Complete unit \$12.95.
 (The above units are ideal for receivers, counters, etc.)

16 LINE TOUCH TONE DECODE KIT WITH P.C. BOARD AND PARTS **\$69.95**

12 LINE TOUCH TONE DECODE KIT WITH P.C. BOARD AND PARTS **\$39.95**

16 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS **\$39.95**

12 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS **\$29.95**

Complete Sets of P.C. Boards Available For: Unicorn Robot Project and Heart-A-Matic Project.

MANY, MANY OTHER KITS AVAILABLE

Send 20 cents stamp or S.A.S. for information and flyer on other HAL-TRONIX products. To order by phone: 1-313-285-1782.



HAL-TRONIX
 P.O. Box 1101
 Southgate, MI 48195

SHIPPING

INFORMATION:

ORDERS OVER \$25.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN \$25.00 PLEASE INCLUDE ADDITION. AL \$2.00 FOR HANDLING AND MAILING CHARGES.

CIRCLE 75 ON FREE INFORMATION CARD

THE WORLD FAMOUS

ETCO

CATALOG OF ELECTRONICS

FREE

LOW PRICES

1000's OF FASCINATING FACTORY CLEAROUTS, SURPLUS SPECIALS AND BARGAIN OFFERS NOT FOUND IN STORES OR CATALOGS ANYWHERE!

• VIDEO
 • TELEPHONE
 • CABLE TV
 • PARTS
 • AUDIO
 • ELECTRONICS
 • and much, much more!

14.99

ETCO ELECTRONICS

DEPT. 591

Mailing List Control Center

Box 840

Champlain, N.Y. 12919

I Enclose (cash OK);

Please rush postpaid

- ☐ \$1 for 1 year subscription to the world famous ETCO catalog.
☐ \$3 Canadian & Foreign 1 year subscription to the ETCO catalog.
☐ 304 page handbook "BUILD YOUR OWN EARTH STATION". (TA025) \$10.00
☐ 360 pages MASTER HANDBOOK OF TELEPHONES. (TA001) \$11.00
☐ FREE - sample copy of the bargain packed ETCO catalog. (USA only)

Name _____

Address _____

City _____

State _____ Zip _____

CIRCLE 50 ON FREE INFORMATION CARD

POPULAR CHIPS

LM 301	.39
LM 380	1.25
LM 386	.79
NE 564	2.50
LM 565	.89
MC 1330	1.10
MC 1350	1.00
MC 1358	1.10
MC 1458	.49
MC 1496	1.50
LM 1889	1.95
7808	.75
7812	.75
7815	.75
7818	.75
MV 2109	.69
2N2222A	.30
MC1349	1.39

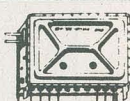


CHOKES

.33 uh	33 uh
.47 uh	100 uh
15 uh	10 mh
18 uh	69¢ each

VARI CAPS

10 - 60 pf	69¢ each
30 - 90 pf	69¢ each



DELUXE PARTS ASSORTMENTS

#1 Resistors & Trimpots
 68 - watt, 5% resistors & 5 PT-15 10K trimpots. 1 each - 51, 75, 100, 470, 1.5K, 3.6K, 51K, 470K, 13-1.2K, 2-220, 3-100K, 6-330, 6-12K, 7-910, 9-3.3K, & 14-4 7K
\$5.25 each

#2 Capacitor "A"
 Monolytics - 1-560pf, 7-1 mfd, & 1-22 mfd
 Silver Micas - 2-10pf, & 1 each of 43pf, 110pf, 560pf, 1200pf, 3000 or 3300pf.
\$5.95 each

#3 Capacitor "B"
 Mylars 4-001, 2-.047, 29-.01, Radial lytics 3-10 mfd 16V, 1-1000 mfd 50V, 1-2200 mfd 35V
 Disc Caps 1 each of 5, 12, 27, 36, 110, 330pf, 2-120pf, 3-39pf, 3-220pf, and 1 Vari Cap 5-35pf.
\$7.50 each

UHF AMP KIT
 25 db gain
 stripline PC board using
 (2) BFR-90's
\$9.95
 power supply for above **\$3.49**

MITSUMI

UES A55F

VARACTOR TUNER

CHAN. 14-83

400 ohm INPUT **\$17.95**

#4 Coil & Chokes

1 each of 15, 33, and 100 (uh) micro henries
 chokes 1-variable RF coil (same as #49A537MPC)
\$3.25 each

#5 IC's, Sockets, & Semi's
 1 each of: NE564, LM565, MC1330, MC1350, MC1496, LM1889, 7812, 7818, 2N2222A, MV2109, heat sink 2-MC1458, 4-1N4002, 4-8 pin, 2-14 pin, 1-16, & 1-18 pin socket.
\$13.25 each

#6 Misc. Hardware
 LED & holder, fuse & holder, line cord, grommet, SPST switch, DPDT switch, 2-F61 conn. & lugs, knob, 4-spacers, 6-screws & nuts, 2'-RG-174, matching transformer w/nut.
\$5.95 each

METAL BOX—PRE-DRILLED
 DIM: 10%W x 4%D x 3" High
 HOLES: 4% in back, 1% in front 2 1/4" in front, 6 #6 on bottom
 PAINTED **\$10.95 ea.**, 10/\$99.50
 25/\$223.75

TERMS: Visa, M.C., Check, Money Order or COD (add \$3.00). Min. Order \$10.00. Add \$2.50 S&H for USA, Ill. add 7% Tax. **MAIL ORDER ONLY.** Prices subject to change without notice. Phone Orders Welcome. WRITE FOR OUR MONTHLY UN-ADVERTISED SPECIALS

NETWORK SALES, INC.

RIBBON CABLE CONNECTOR

These very popular 40 PIN ribbon cable connectors are used by a number of mfgs. of micros for internal board to board terminations and I/O port connections.
W/strain relief \$2.50

40 CONDUCTOR RIBBON CABLE

gray color 70¢/ft.

MINI FAN 3.125" SQ.

40 CMF

115VAC-60hz

REMOVED FROM NEW EQUIP.

TESTED **\$6.95**

POWER TRANSFORMERS

Pri: 115V AC
 Sec: 24 volts @ .350 A
 Dim: 2 1/4 x 1 x 1 H

\$1.95 ea. 10/\$15.00 100/\$125.00

THUMBWHEEL TRIMMER POTS VERTICAL MOUNT
 OHMS 500, 1K, 2K, 5K, 10K, 25K 50K, 100K, 200K, 500K, 1 MEG.
4/\$1.00 100/\$20.00

MINI COAX CABLE

RG-174 50ohm .100 OD
10 feet/\$1.00

SOLID CARBIDE PC DRILL

#55 1/8 in. SHANK FOR USE WITH DREMEL TOOL
\$1.00

DIP SWITCHES

High quality DIP switches mfg. by CTS. Available in the following configurations.

4 POS—80¢ 6 POS—80¢
 5 POS—80¢ 7 POS—80¢

DB-25 S (FEMALE)

The most popular computer connector. Mfg. by AMP. .025" gold PC pins with mfg. holes.

\$1.95

BRIDGE RECTIFIERS

35A 200 PIV **\$2.00**
 25A 100 PIV **\$1.50**
 3A 400 PIV **\$1.00**

THUMBWHEEL SWITCH

\$7.95 BCD 0-9
 W/COMPLIMENT

(EACH DIGIT ILLUMINATED W/LED)

4 DIGIT
 W/END PLATES FOR EASY MTG.

4 TURN TRIM POTS

BOURNS #3339B
 1K — 6K R/A — 10K
\$1.49 EA.

RF COIL

Same as #49A537MPC
\$1.50 ea. 10/\$12.50

This will be
coming to you
when you
subscribe to
Radio-Electronics:

• **HELPFUL
CONSTRUCTION
ARTICLES . . .**

Test Equipment
Hi-Fi Accessories
Telephone Accessories
Music Synthesizers
Computer Equipment
Automotive Equipment
Intruder Alarms
Home & Car
Video Accessories

• **NEWS ON NEW
TECHNOLOGY . . .**

Computers
Microprocessors
Satellite TV
Teletext
Automotive Electronics
Speech Synthesizers
IC Applications

• **FASCINATING
"HOW TO DO IT"
ARTICLES . . .**

Build Your Own
Projects
Make Your Own PC
Boards
Wiring Techniques
Soldering and
Desoldering
Design and Prototyping

Radio- Electronics

COMPUTERS - VIDEO - STEREO - TECHNOLOGY - SERVICE

HOW TO REJUVENATE
ANTIQUE RADIOS

\$1.50 MAR. 1983
U.K. 85p

Portable
SHORTWAVE RECEIVER
Buyers guide

Inside the new
767 COCKPIT

Build an
ACTIVE ANTENNA
for your VLF receiver

Back-to-school series
POWER AMPLIFIERS

Inexpensive and versatile
2 DVM CIRCUITS
you can build

PLUS:

★ Videogames ★ Hobby Corner
★ Computer Corner ★ Drawing Board
★ State-Of-Solid-State ★ Equipment Reports



Radio-Electronics covers all
aspects of the fast moving
electronics field . . . featuring
**COMPUTERS • VIDEO • STEREO
TECHNOLOGY • SERVICE
COMMUNICATIONS • PROJECTS**

Get it all!

• **HOW YOU AND THE COMPUTER
CAN BE FRIENDS . . .**

Getting Started
Programs, Circuit
Design, Games
A/D-D/A Interfacing
Peripheral Equipment

• **NEW AUDIO DIMENSIONS
FOR YOUR PLEASURE . . .**

Noise-Reduction Devices
How to Connect that
Extra Add-On
Hi-Fi Accessories
New Technology

• **TV WONDERS FOR YOUR
FUTURE . . .**

Latest Receivers and
Circuits
The Home Entertainment
Center
Projection TV Today
Satellite TV Receivers
Jack Darr's Monthly
Service Clinic
Service Problems and
Solutions

• **AND you also get these
regular MONTHLY FEATURES:**

• **LOOKING AHEAD**
by Dave Lachenbruch
• **HOBBY CORNER**
by "Doc" Savage
• **STATE-OF-SOLID-STATE**
by Bob Scott
• **WHAT'S NEWS**, new
products, stereo news
• **VIDEOGAMES**, new
products, game reviews
• **and NEW IDEAS, STEREO
PRODUCTS, NEW
COMPUTER PRODUCTS
FOR HOME/JOB and
MUCH MORE!**

Subscribe today to **Radio-Electronics**. Don't miss a single
issue and . . . you save as much as \$7.03 off the
newsstand price.

When you select one of the subscription offers listed on the handy
coupon—you'll be assured of having your copy reserved,
even if it sells out on the newsstand. Make sure
you get all the excitement in every issue of
Radio-Electronics, every month, by
filling in and mailing the
coupon, today.

Mail to: **Radio-Electronics**
P.O. Box 2520, Boulder, CO 80322

Every Month!
Get the Best—Mail Today!

7HL3

- ☐ 1 year—**12 issues only \$14.97** (You save \$3.03 off newsstand price.)
☐ 2 years—**(Save More)—24 issues—\$28.97** (Save \$7.03 off the newsstand price.)

- ☐ Payment Enclosed
☐ Bill Me

Name _____ (please print)

Address _____

City _____ State _____ Zip Code _____

Offer Valid In U.S. Funds Only.
Allow 6-8 weeks for delivery of first issue

Canada—Add \$3.00 per year
All other countries—Add \$7.50 per year

DoKay Computer Products, Inc.

VISIT OUR RETAIL STORE

2100 DE LA CRUZ BLVD.

SANTA CLARA, CA 95050

8000		
8035	4.95	8251 4.39
8039	5.95	8253 6.89
8080A	3.89	8253-5 7.89
8085A	5.89	8255 4.39
8086	24.95	8255-5 5.19
8088	34.95	8257 7.89
8155	7.75	8259 6.85
8156	8.75	8272 39.00
8185	29.00	8275 29.00
8202	27.95	8279 8.89
8205	3.45	8279-5 9.89
8212	1.79	8282 6.49
8214	3.75	8283 6.49
8216	1.69	8284 5.49
8224	2.19	8286 6.49
8228	1.79	8287 6.49
8237	3.34	8288 24.95
8238	19.00	8289 39.00
8238	4.39	8741 34.95
8243	4.39	8748 14.95
8250	10.49	8755 29.95

DISC CONTROLLERS	INTERFACE
1771 15.95	8T26 1.65
1791 27.95	8T28 1.95
1793 29.95	8T95 .95
1795 49.95	8T96 .95
1797 49.95	8T97 .95
6843 32.95	8T98 .95
8272 39.00	DM8131 2.90
UPD765 34.95	DP8304 2.25
1691 17.95	DS8835 1.89
	DS8836 .99

EPROM ERASERS
HOLDS 15 EPROMS
ERASES IN 20 MINUTES
59.95

CONNECTORS
RS232 Male 3.00
RS232 Female 3.50
RS232 Female RA 4.95
RS232 Hood 1.20

6500 1 MHz	
6502	5.25
6504	6.85
6505	7.60
6507	9.85
6520	3.95
6522	4.95
6532	5.95
6545	16.95
6551	10.95

UPGRADE YOUR APPLE or TRS-80 4116 200ns CALL

CRYSTALS		
32.768 KHz	1.90	6.144 2.69
1.00 Hz	4.50	6.5536 2.69
1.8432	4.50	8.0 2.69
2.0	3.90	10.0 2.69
2.097152	3.90	12.0 2.69
2.4576	2.69	14.31818 2.69
3.2768	2.69	15.0 2.69
3.579545	2.69	16.0 2.69
4.0	2.69	17.430 2.69
5.0	2.69	18.0 2.69
5.0688	2.69	18.432 2.69
5.185	2.69	20.0 2.69
5.7143	2.69	22.1184 2.69
6.0	2.69	

EPROMS		STATIC RAMS	
1702	1ns	2.95	2101 450ns 1.80
2708	450ns	2.98	2102L-2 250nsLP 1.44
2716	450ns	3.90	2111 450ns 3.45
2716-1	350ns	5.90	2114 450ns 1.74
2532	450ns	5.35	2114L-4 450nsLP 1.84
2732	450ns	4.90	2114L-3 300nsLP 1.84
2764	450ns	CALL	2114L-2 200nsLP 1.94
DYNAMIC RAMS			
TMS 4027	250ns	.79	TMS4044-4 450ns 3.15
UPD 411	300ns	2.89	TMS4044-3 300ns 3.45
MM 5280	300ns	2.89	TMS4044-2 200ns 3.89
MK4108	200ns	1.74	MM4118 250ns 9.69
MM 5298	250ns	1.74	TMM2016 200ns 4.15
			TMM2016 150ns 4.89
4027	250ns	2.00	HM6116-4 200ns 5.90
4116	200ns	CALL	HM6116-3 150ns 6.90
4116	150ns	CALL	HM6116-2 120ns 8.95
4164	200ns	CALL	Z6132 300ns 32.95
4164	150ns	CALL	

LP = LOW POWER

5 1/4" DISKETTES	
ATHANA OR NASHUA	
SSSD	18.95
SSDD	22.95
DSDD	27.95

BULK SSDD SOFT \$1.65 EA

74LS00 SERIES

74LS00	.23	74LS123	.77	74LS253	.57
74LS01	.23	74LS124	2.88	74LS257	.57
74LS02	.23	74LS125	.47	74LS258	.57
74LS03	.23	74LS126	.47	74LS259	2.73
74LS04	.23	74LS132	.57	74LS260	.57
74LS05	.23	74LS136	.37	74LS266	.53
74LS08	.23	74LS137	.97	74LS273	1.47
74LS10	.23	74LS138	.53	74LS275	3.33
74LS11	.25	74LS139	.53	74LS279	.47
74LS12	.25	74LS145	1.18	74LS280	1.96
74LS13	.39	74LS147	2.47	74LS283	.67
74LS14	.39	74LS148	1.33	74LS290	.87
74LS15	.29	74LS151	.53	74LS293	.87
74LS20	.23	74LS153	.53	74LS295	.97
74LS21	.23	74LS154	1.88	74LS298	.87
74LS22	.23	74LS155	.67	74LS324	1.73
74LS26	.29	74LS156	.67	74LS352	1.27
74LS27	.23	74LS157	.63	74LS353	1.27
74LS28	.29	74LS158	.57	74LS363	1.33
74LS30	.23	74LS160	.67	74LS364	1.93
74LS32	.25	74LS161	.63	74LS365	.47
74LS33	.49	74LS162	.67	74LS366	.47
74LS37	.29	74LS163	.63	74LS367	.43
74LS38	.29	74LS164	.67	74LS368	.43
74LS40	.23	74LS165	.93	74LS373	1.37
74LS42	.43	74LS166	1.93	74LS374	1.37
74LS47	.49	74LS168	1.73	74LS377	1.37
74LS48	.74	74LS169	1.73	74LS378	1.17
74LS49	.74	74LS170	1.47	74LS379	1.33
74LS51	.23	74LS173	.67	74LS385	1.88
74LS54	.23	74LS174	.53	74LS386	.43
74LS55	.28	74LS175	.53	74LS390	1.17
74LS63	1.23	74LS181	2.13	74LS393	1.17
74LS73	.37	74LS189	8.93	74LS395	1.17
74LS74	.33	74LS190	.87	74LS399	1.47
74LS75	.37	74LS191	.87	74LS424	2.93
74LS76	.37	74LS192	.77	74LS447	.35
74LS78	.47	74LS193	.77	74LS490	1.93
74LS83	.58	74LS194	.67	74LS668	1.67
74LS85	.67	74LS195	.67	74LS669	1.87
74LS86	.37	74LS196	.77	74LS670	1.47
74LS90	.53	74LS197	.77	74LS674	9.63
74LS91	.87	74LS221	.87	74LS682	3.18
74LS92	.53	74LS240	.93	74LS683	3.18
74LS93	.53	74LS251	.59	74LS684	3.18
74LS95	.73	74LS242	.97	74LS685	3.18
74LS96	.87	74LS243	.97	74LS688	2.38
74LS107	.37	74LS244	1.27	74LS689	3.18
74LS109	.37	74LS245	1.47		
74LS112	.37	74LS247	.73	81LS95	1.47
74LS113	.37	74LS248	.97	81LS96	1.47
74LS114	.37	74LS249	.97	81LS97	1.47
74LS122	.43	74LS251	.57	81LS98	1.47

IC SOCKETS	
ST	W/W
8 PIN .10	.49
14 PIN .12	.50
16 PIN .15	.57
18 PIN .20	.85
20 PIN .25	.99
22 PIN .25	1.30
24 PIN .25	1.40
28 PIN .35	1.50
40 PIN .40	1.80

Z 80 SERIES

2.5 MHz

Z80-CPU	3.35
Z80-PIO	3.35
Z80-CTC	3.35
Z80-DMA	12.49
Z80-DART	14.98
Z80-SIO/O	16.95
Z80-SIO/1	16.95
Z80-SIO/2	16.95
Z80-SIO/9	16.95

4.0 MHz

Z80A-CPU	4.90
Z80A-PIO	4.90
Z80A-CTC	4.90
Z80A-DMA	21.95
Z80A-DART	15.95
Z80A-SIO/O	20.95
Z80A-SIO/1	20.95
Z80A-SIO/2	20.95
Z80A-SIO/9	18.95

6.0 MHz

Z80B-CPU	14.95
Z80B-PIO	12.95
Z80B-CTC	12.95

ZILOG

Z6132	32.95
Z8671	38.95

ORDER TOLL FREE
(800) 538-8800
(800) 848-8008
(CALIFORNIA RESIDENTS)
ALL MERCHANDISE IS 100% GUARANTEED

APPLE JOYSTICKS
29.95

APPLE PADDLES
9.95

APPLE SUPER COOLING FANS
49.95
WITH SURG PROTECH
69.95

APPLE* II COMPATIBLE DISK DRIVE
225.95
CONTROLLER CARD
79.95

DoKay Computer Products, Inc.
2100 De La Cruz Blvd.
Santa Clara, CA 95050
(800) 538-8800
Calif. Residents (800) 848-8008



CIRCLE 99 ON FREE INFORMATION CARD

TERMS: For shipping include \$2.00 for UPS Ground. \$3.00 for UPS Blue Label Air. \$10.00 minimum order. Bay Area residents add 6 1/2% Sales Tax. California residents add 6% Sales Tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice. Send SASE for complete list.

SPARTAN Electronics Inc.



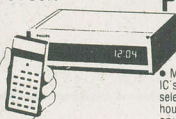
CALL

MAIL

(516) 499-9500

6094 Jericho Tpke.
Commack, N.Y. 11725

CTC9R



Philips Remote Cable Converter

\$139.95

• Micro computer technology • Quartz controlled IC's lock in picture & prevent drift • 60 channel selections • Programmable time on & off • 24 hour LED digital clock • Favorite channel memory & recall plus scan • Wireless hand held "infra-red" transmitter system • Automatic fine tune • Adaptable to any brand television • One year warranty service

CABLE TV ACCESSORIES

2 set coupler	2.95
Coax Cable 100'	9.95
4 set coupler	4.50
F Connectors	25
Matching transformer	.99
TV Game Switch	3.95
VHF-UHF AMP-28DB	29.95
Crimp Tool for F Conn	8.95

700' CORDLESS PHONE

FM duplex circuitry. Last number redial. Base can signal remote to pick-up. Rechargeable ni-cad batteries.

\$89.95



Mura 400

SGL WABER \$35.95

Protect your computer and electronic equipment from voltage spikes

DG115P

DG115S

(6 Outlet)

\$45.95



WINEGARD FM CAR ANTENNA BOOSTER

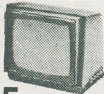
Amplifies FM radio signals an average of 18dB (8 times). Improves car radio reception and extends range to allow greater selection of stations. Switch and indicator light attaches to lower edge of dash. 24" cable with Motorola plugs provided. Installs in minutes. Great for window antennas.

\$26.95

REFURBISHED MONITORS

9", 12", Commercial Grade as low as

\$39.95



10KM Cordless Telephone

Model 5500M (modified)

\$325.00

External Antenna required For export use only



BECKMAN CIRCUITMATE 20

8 functions and 30 ranges - Diode/transistor test function - auto-polarity, auto-zero, and auto-decimal - 10 Amps AC and DC Current Capability - Transistor Gain Test (hFE) - Conductance



\$64.95

Jerrold 36 Channel Remote CATV Converter

w/on/off Fine Tuning \$94.95

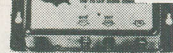
58 Channel Wireless \$109.95



40 Channel VHF to UHF Block Converter

28.95 Ea.

24.95 4 & up



Deluxe Version - Features fine tuning knob, matching X former & 2 cables \$38.95

Dealers Welcome

Visa MC BAC Amex. All above prices include 4% cash discount C.O.D. money order, check Add for Shipping

Min. Order \$25.00		
International Shipping Add'l	to 75.00	\$2.50
Prices subject to change without notice.	76.00 to 250.00	\$4.50
COD 2.00 Extra	251.00 to 500.00	\$6.00
*Add'l shipping for monitors	501.00 to 750.00	\$8.50
	751.00 to 1000.00	\$12.00
	Over 1000.00	\$12.50

(516) 499-9500 Mon Th 9-8 Tu W F 9-6 Sa 9:30-5

CIRCLE 47 ON FREE INFORMATION CARD

ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

Free Information Number	Page		
92	Action Electronics	113	30
3	Active Electronics	144	24
—	Advance Electronics	28-31	—
80	Advanced Computer Products	145	61
73	All Electronics	133	79
—	AMC Sales	152	27
87	AP Products	91-98	32
89	Arizona Electronic Surplus	148	—
56	Automated Production Equipment	88	25
60	BBC Metrawatt	11	55, 64
10	Beckman Instruments	71-74	82
67	Beta Electronics	147	23
77	BK Precision Dynascan	99	43
5	Byte-Ryte	1	47
7	Calvert	9	12
—	C D Electronics	107	—
18	CEI	24	38
34	Chaney Electronics	150	8
—	CIE, Cleveland Institute of Electronics	34-37	—
45	Circuit Specialists	152	—
—	Command Production	107	91
22, 81	Communications Electronics	2, 15	97
88	Components Express	123	—
68	Computer Products	—	13
—	Peripherals	132	—
86	Cooper Tools	Cover II	—
84	CRT Factory	113	—
95	Diamondback Electronics	134	—
65	Digi-Key	136, 137	—
11	Digitron	132	—
53	Direct Video Sales	111	—
99	Dokay Computer Products	155	—
28	R. L. Drake	20	—
58	EICO	107	—
26	Electro Industries	111	—
59	Electronic Rainbow	22	—
6	Electronic Specialists	130	—
33	Electronic Warehouse	41	—
—	Electronics Book Club	115, 116	—
50	ETCO	153	—
39	Etronix	107	—
78	E. Z. Hook	26	—
40	Firestick Antenna	152	—
—	Fordham Radio	39, 87	—
76	Formula International	131	—
21	Gamit Appliance Service	113	—
98	Gamma Electronics	144	—
—	Gilco International	132	—
9, 71	Gladstone Electronics	89, 105	—
96	Global Specialties	103	—
17	Glouster Computer	124	—
69	Goldsmith Scientific	89	—
—	Grantham College of Engineering	32	—
75	Hal-tronix	153	—
37	Heath	27	—
85	Hickok Electrical Instrument	100	—
94	Illinois Audio	109	—
15	Iwatsu	85	—
—	ISCET	111	—
41	Jameco Electronics	127, 128, 129	—
49	JDR Microdevices	140-143	—
57	Jensen Tools	113	—
63	J W Electronics	113	—
—	J. S. A.	5	—
83	KCS Electronics	150	—
36	Keithley	25	—
48	Kikisui	Cover III	—
4	H. J. Knapp	144	—
44	L.I. Public Wholesalers	148	—
93	McIntosh Labs	103	—
66	MFJ Enterprises	152	—
46	Microsignal	124	—
20	Mouser	144	—
16	Multitech	44	—
90	Netronics R D Ltd	109	—
—	Network Sales	152	—
—	New Horizons	43, 118	—
—	Newton Electronics	90	—
—	NRI Schools	16-19	—
—	NTS Schools	52-55	—
19	OK Industries	Cover IV	—
62	Optoelectronics	13	—
51	Pacific 1	113	—
52	PAIA Electronics	109	—
35	Paladin	40	—
29	Philips-Tech Electronics	150	—
—	Professional Video	134	—
—	Protecto Enterprises	23	—
—	Radio-Electronics Reprint	—	—
—	Bookstore	148	—
—	Radio Shack	125	—
—	Ramsey Electronics	135	—
—	R.F. Electronics	134	—
—	Sams Books	38	—
—	Scientific Systems	153	—
—	SCR Electronics Center	130	—
—	SEI	148, 149	—
—	Sintec	21	—
—	Solid State Sales	130	—
—	Soltec	100	—
—	Spartan Electronics	156	—
—	Spectrum Electronics	139	—
—	Symmetric Sound Systems	113	—
—	Taft Electronics	89	—
—	Tek-El	134	—
—	Tektronix	7	—
—	Texas Instruments	42	—
—	T.V. Products	113	—
—	VIZ Manufacturing	33	—
—	Wahl Clipper	88	—
—	Wersi	99	—
—	Westech	150	—

MOVING?

Don't miss a single copy of **Radio-Electronics**. Give us:

Six weeks' notice

Your old address and zip code

Your new address and zip code

ATTACH LABEL HERE

name (please print)

address

city

state

zip code

Mail to: Radio-Electronics
SUBSCRIPTION DEPT., P.O. BOX 2520,
BOULDER, COLO. 80322

FOR FREE INFORMATION USE THESE POST-PAID CARDS

1

Print your name, address and Zip Code on one of the attached post-paid cards.

2

Circle the number (or numbers) on the card that corresponds to the number at the bottom of each advertisement or editorial item that you want information on. Advertisers' free-information numbers also appear in the ad index at the left on the facing page.

3

Mail the card. It's Postage-Paid.

NOTE:

Use the postcard address for Free Product Information only. Address all editorial inquiries to Editor, RADIO-ELECTRONICS, 200 Park Avenue South, New York, N.Y. 10003.

POSTAGE-PAID FREE INFORMATION CARD

Only one card per person

REA1183

11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
12	22	32	42	52	62	72	82	92	102	112	122	132	142	152
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

2 ☐ Please send me 12 issues of RADIO-ELECTRONICS for \$14.97 and bill me. (Canada \$17.97—US Funds only)

NAME Please print _____

COMPANY NAME (if applicable) _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

VOID after January 31, 1984

IMPORTANT
Allow 6-8 weeks for delivery of first issue

POSTAGE-PAID FREE INFORMATION CARD

Only one card per person

REA1183

11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
12	22	32	42	52	62	72	82	92	102	112	122	132	142	152
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

2 ☐ Please send me 12 issues of RADIO-ELECTRONICS for \$14.97 and bill me. (Canada \$17.97—US Funds only)

NAME Please print _____

COMPANY NAME (if applicable) _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

VOID after January 31, 1984

IMPORTANT
Allow 6-8 weeks for delivery of first issue



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

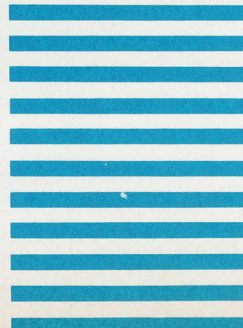
FIRST CLASS PERMIT NO. 597 BOULDER, COLORADO

Radio-Electronics®

SUBSCRIPTION SERVICE

P.O. Box 2520

BOULDER, COLORADO 80321





NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA.

POSTAGE WILL BE PAID BY ADDRESSEE

Radio-Electronics®

FREE PRODUCT INFORMATION

P.O. Box 13775
PHILADELPHIA, PA. 19101



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA.

POSTAGE WILL BE PAID BY ADDRESSEE

Radio-Electronics®

FREE PRODUCT INFORMATION

P.O. BOX 13775
PHILADELPHIA, PA. 19101



RADIO-ELECTRONICS

4SL33

Subscribe today to the magazine that keeps you up-to-date with the newest ideas and innovations in electronics. (If you already are a subscriber, do a friend a favor and pass this subscription card along to him.)

check offer preferred

- | | |
|---|---|
| <input type="checkbox"/> 1 Year—12 issues ONLY \$14.97
(You save \$3.03 over newsstand) | <input type="checkbox"/> 2 Years (SAVE MORE)—24 issues \$28.97
(You save \$7.03 over newsstand) |
| <input type="checkbox"/> Canada—12 issues \$17.97 | <input type="checkbox"/> Canada—24 issues \$34.97 |
| <input type="checkbox"/> All other countries—12 issues \$22.47 | <input type="checkbox"/> All other countries—24 issues \$43.97 |

☐ Payment enclosed

☐ Bill Me

☐ Check here if you are extending or renewing your subscription

Name (Please Print) _____

Company Name (If applicable) _____

Address _____

City _____ State _____ Zip _____

Allow 6-8 weeks for delivery of first issue

Offer valid in US \$ Only.

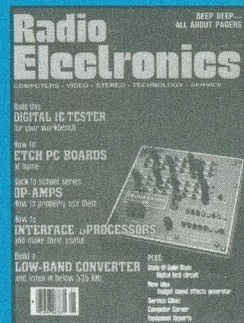
For new ideas in electronics read Radio-Electronics

During the next 12 months

Radio-Electronics will carry up-to-the-minute articles on:

- hobby computers
- solid-state technology
- TV games • Video
- color TV • stereo
- test equipment
- radio
- radar detectors
- industrial electronics
- servicing
- TV-radio-stereo
- experimenter circuits
- exceptional construction projects

Don't take a chance on missing even one issue. Subscribe now and save!



NEW IDEAS AND INNOVATIONS IN ELECTRONICS

The newest ideas and innovations in electronics appear in Radio-Electronics. Keep up-to-date!

Subscribe Today!

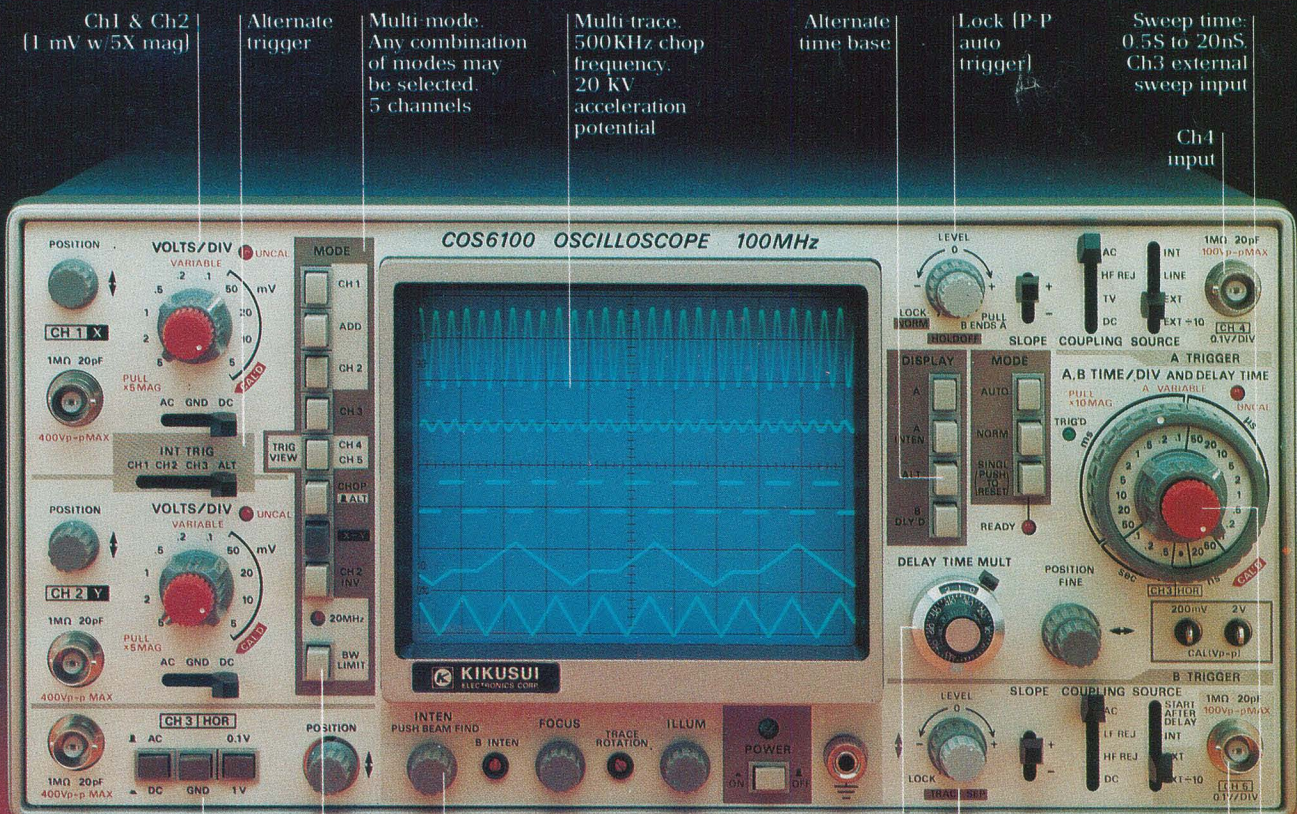
The 100 MHz scope that won the largest scope contract ever awarded...

Now just \$1,950.

For sales and technical
information: call toll free
800-421-5334 (in Calif., Alaska,
Hawaii 213-515-6432)

Kikusui International Corp.
17819 Figueroa Street, Gardena, Calif. 90248
TWX 910-346-7648
In Canada call: Interfax Systems, Inc. 514-336-0392
Subsidiary of Kikusui Electronics Corp., 3-1175
Shinmaruko-Higashi, Nakaharu-Ku, Kawasaki City,
Japan (044)-411-0111 © Kikusui International 1983

KIKUSUI



Ch1 & Ch2
[1 mV w/5X mag]

Alternate
trigger

Multi-mode.
Any combination
of modes may
be selected.
5 channels

Multi trace.
500KHz chop
frequency.
20 kV
acceleration
potential

Alternate
time base

Lock [P-P
auto
trigger]

Sweep time:
0.5S to 20nS.
Ch3 external
sweep input

Ch4
input

3rd channel
[0.1 & 1V/div]

20 MHz
bandwidth
limit

Beam
finder

Calibrated
sweep delay

A & B
trace
separation
for alternate
sweep

Ch5
input

10X
sweep mag

CIRCLE 48 ON FREE INFORMATION CARD

OK's Hot Tip for Desoldering Problems

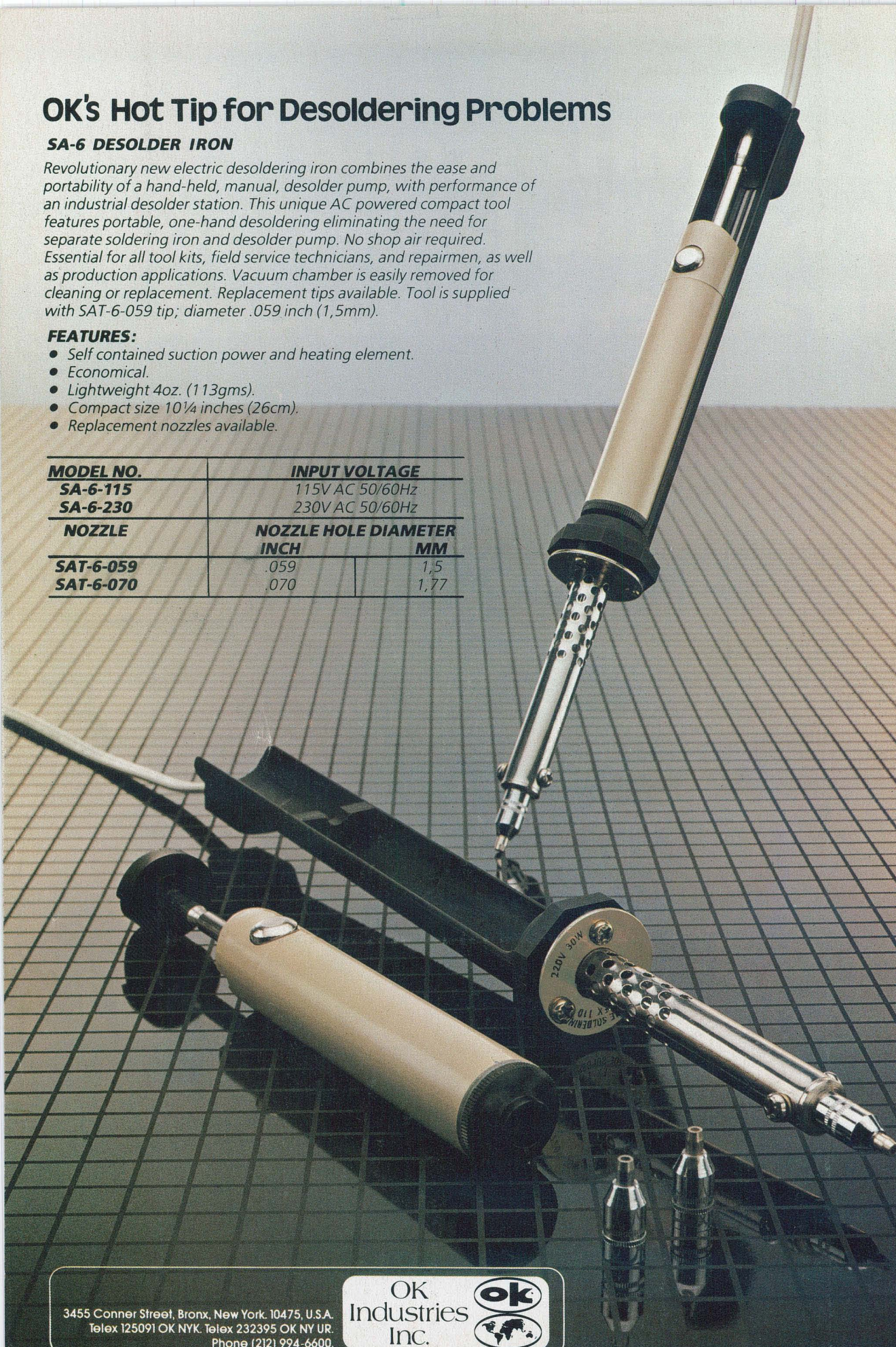
SA-6 DESOLDER IRON

Revolutionary new electric desoldering iron combines the ease and portability of a hand-held, manual, desolder pump, with performance of an industrial desolder station. This unique AC powered compact tool features portable, one-hand desoldering eliminating the need for separate soldering iron and desolder pump. No shop air required. Essential for all tool kits, field service technicians, and repairmen, as well as production applications. Vacuum chamber is easily removed for cleaning or replacement. Replacement tips available. Tool is supplied with SAT-6-059 tip; diameter .059 inch (1,5mm).

FEATURES:

- Self contained suction power and heating element.
- Economical.
- Lightweight 4oz. (113gms).
- Compact size 10 1/4 inches (26cm).
- Replacement nozzles available.

MODEL NO.	INPUT VOLTAGE	
SA-6-115	115V AC 50/60Hz	
SA-6-230	230V AC 50/60Hz	
NOZZLE	NOZZLE HOLE DIAMETER	
	INCH	MM
SAT-6-059	.059	1,5
SAT-6-070	.070	1,77



3455 Conner Street, Bronx, New York. 10475, U.S.A.
Telex 125091 OK NYK. Telex 232395 OK NY UR.
Phone (212) 994-6600.

OK
Industries
Inc.



CIRCLE 19 ON FREE INFORMATION CARD